

Project Manual

DATE: July 28, 2020

BEAVERCREEK TOWNSHIP FIRE STATION NO. 65

1777 Trebein Road
Beavercreek Township, Ohio 45385



615 Woodside Drive, Englewood, Ohio 45322

T 937.836.8898 F 937.832.3696

www.app-arch.com

PROJECT NUMBER: 3541.01

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Table of Contents

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

Division 00 – Beaver Creek Township Procurement and Contracting Requirements

- Legal Notice
- Instructions to Bidders
- Owner-Contractor Agreement
- AIA A201 General Conditions of the Contract for Construction
- Bid Form
- Contractor's Personal Property Tax Affidavit
- Contractor's Qualification Statement
- Bid Guaranty and Contract Bond
- Pre-Bid Substitution Form
- Tax Exemption Certificate
- Statement of Claim Form
- Certificate of Substantial Completion
- Contractor's Affidavit and Certification with List of Subcontractors/Suppliers Amounts Withheld
- Contractor's Waiver and Release Affidavit
- Subcontractors/Suppliers Waiver and Release Affidavit
- Contractor's Final Waiver and Release Affidavit
- Subcontractors/Suppliers Final Waiver and Release Affidavit
- Prevailing Wage Rates

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 01 - General Requirements

- 01 1000..... Summary
- 01 2100..... Allowances
- 01 2200..... Unit Prices
- 01 2300..... Alternates
- 01 2500..... Substitution Procedures
- 01 3100..... Project Management and Coordination/Site Logistics Plan
- 01 3200..... Construction Progress Documentation
- 01 3300..... Submittal Procedures
- 01 4000..... Quality Requirements/CAD Waivers
- 01 5000..... Temporary Facilities and Controls
- 01 5639..... Temporary Tree and Plant Protection
- 01 6000..... Product Requirements
- 01 7300..... Execution
- 01 7419..... Construction Waste Management and Disposal
- 01 7700..... Closeout Procedures
- 01 7823..... Operation and Maintenance Data
- 01 7839..... Project Record Documents
- 01 7900..... Demonstration and Training

FACILITY CONSTRUCTION SUBGROUP

Division 03 - Concrete

- 03 3000..... Cast-in-Place Concrete
- 03 3543..... Polished Concrete Finishing

Division 04 - Masonry

- 04 2200..... Concrete Unit Masonry
- 04 4313..... Anchored Brick and Masonry Veneer
- 04 7200..... Cast Stone Masonry

Division 05 - Metals

- 05 0519..... Post Installed Anchors
- 05 1200..... Structural Steel Framing
- 05 3100..... Steel Decking
- 05 4000..... Cold-Formed Metal Framing
- 05 5000..... Metal Fabrications
- 05 5113..... Metal Pan Stairs

Division 06 - Wood, Plastics, and Composites

- 06 1053..... Miscellaneous Rough Carpentry
- 06 1600..... Sheathing
- 06 1753..... Shop-Fabricated Wood Trusses
- 06 4023..... Interior Architectural Woodwork

Division 07 - Thermal and Moisture Control

- 07 1900..... Water Repellents
- 07 2100..... Thermal Insulation
- 07 2500..... Weather Barriers
- 07 3113..... Asphalt Shingles
- 07 4113.16 Standing Seam Roof (Alternate G-1)
- 07 4200..... Solid Phenolic Exterior Wall Cladding
- 07 4213.53 Metal Soffit Panels
- 07 6200..... Sheet Metal Flashing and Trim
- 07 7100..... Roof Specialties
- 07 7253..... Snow Guards (Alternate G-1)
- 07 9200..... Joint Sealants

Division 08 - Openings

- 08 1113..... Hollow Metal Doors and Frames
- 08 1416 Flush Wood Doors
- 08 3613..... Sectional Doors
- 08 4113..... Aluminum-Framed Entrances and Storefronts
- 08 7100..... Door Hardware
- 08 8000..... Glazing
- 08 9000..... Louvers and Vents

Division 09 - Finishes

- 09 2216.....Non-Structural Metal Framing
- 09 2900.....Gypsum Board
- 09 3100.....Tiling
- 09 5113.....Acoustical Panel Ceilings
- 09 6513.....Resilient Base and Accessories
- 09 6516.13 Linoleum Flooring (Alternate G-2)
- 09 6566.....Resilient Athletic Flooring
- 09 6700.....Fluid Applied Flooring for Concrete
- 09 6813.....Tile Carpeting
- 09 9113.....Exterior Painting
- 09 9123.....Interior Painting

Division 10 - Specialties

- 10 1419.....Dimensional Letter Signage
- 10 2600.....Impact-Resistant Wall Protection
- 10 2800.....Toilet and Bath Accessories
- 10 4413.....Fire Protection Cabinets
- 10 4416.....Fire Extinguishers
- 10 7500.....Flagpoles

FACILITY SERVICES SUBGROUP

Division 21 - Fire Suppression

- 21 0001.....Basic Fire Suppression Requirements
- 21 0004.....Firestopping for Fire Suppression Systems
- 21 0519.....Meters and Gauges
- 21 0529.....Pipe Hangers and Supports
- 21 0553.....Identification for Fire Suppression Systems
- 21 1313.....Wet-Pipe Sprinkler Systems
- 21 2213.....Clean-Agent Fire Extinguishing Systems

Division 22 - Plumbing

- 22 0001.....Basic Plumbing Requirements
- 22 0004.....Firestopping for Plumbing Systems
- 22 0005.....Excavation, Backfill and Surface Restoration
- 22 0513.....Electrical Requirements for Plumbing Equipment
- 22 0519.....Meter and Gauges
- 22 0520.....Common Piping Materials and Methods
- 22 0523.....General Duty Valves
- 22 0529.....Pipe Hangers and Supports
- 22 0530.....Equipment Bases and Supports
- 22 0553.....Identification for Plumbing Systems
- 22 0719.....Piping Insulation
- 22 1116.....Domestic Water Piping
- 22 1119.....Domestic Water Piping Specialties
- 22 1123.....Domestic Water Pumps

22 1316.....	Sanitary Waste and Vent Piping
22 1319.....	Sanitary Waste Piping Specialties
22 1513.....	General Service Compressed Air Piping
22 1613.....	Natural Gas House Piping
22 3116.....	Water Softeners
22 3436.....	Gas-Fired Storage Water Heaters
22 4200.....	Plumbing Fixtures

Division 23 - Heating, Ventilating, and Air Conditioning

23 0001.....	Basic HVAC Requirements
23 0004.....	Firestopping for HVAC Systems
23 0513.....	Electrical Requirements for HVAC Equipment
23 0525.....	Flexible Pipe Connectors
23 0529.....	Pipe Hangers and Supports
23 0548.....	Vibration Control
23 0553.....	Identification for HVAC Systems
23 0593.....	Testing, Adjusting and Balancing
23 0713.....	Duct Insulation
23 0716.....	Equipment Insulation
23 0914.....	Control Wiring and Cabling
23 0950.....	Variable Frequency Motor Controllers (VFD's)
23 0993.....	Sequence of Operations for Controls
23 2113.....	Hydronic Piping
23 3113.....	Ductwork
23 3119.....	Plenum Casings
23 3300.....	Air Duct Accessories
23 3400.....	Fans
23 3713.....	Diffuser, Registers and Grilles
23 5100.....	Breechings, Chimneys and Stacks
23 5523.....	Gas-Fired Radiant Heaters

Division 26 - Electrical

26 0001.....	Basic Electrical Requirements
26 0004.....	Firestopping for Electrical Systems
26 0005.....	Excavation, Backfill and Surface Restoration
26 0519.....	Low-Voltage Electrical Power Conductors and Cables
26 0523.....	Control-Voltage Electrical Power Cables
26 0526.....	Grounding and Bonding for Electrical Systems
26 0529.....	Hangers and Supports for Electrical Systems
26 0533.....	Raceway and Boxes for Electrical Systems
26 0543.....	Underground Ducts and Raceways for Electrical Systems
26 0553.....	Identification for Electrical Systems
26 0563.....	Specific Wiring Applications
26 0923.....	Lighting Control Devices
26 0943.....	Network Lighting Controls
26 2416.....	Panelboards
26 2726.....	Wiring Devices
26 2813.....	Fuses

26 2816.....	Enclosed Switches and Circuit Breakers
26 2913.....	Enclosed Motor Controllers
26 3214.....	Engine Generators (Natural Gas)
26 3623.....	Automatic Transfer Switches
26 4313.....	Surge Protective Devices (SPD) for Low-Voltage Electrical Power Circuits
26 5113.....	Interior Lighting Fixtures, Lamps and Ballasts
26 5200.....	Exit and Emergency Lighting
26 5600.....	Exterior Area Lighting
26 6101.....	Fire Detection and Alarm System
26 7000.....	Suspended Ceiling Mounted Circulation Fans
26 7510.....	Data Equipment Room Fittings
26 7533.....	Raceway and Boxes for Communications Systems
26 7561.....	Voice and Data Communications Horizontal Cabling

Division 28 - Electronic Safety and Security

28 1300.....	Access Control and Security Management Software
28 2113.....	Cameras

SITE AND INFRASTRUCTURE SUBGROUP

Division 31 - Earthwork

31 1000.....	Site Clearing
31 2000.....	Earth Moving

Division 32 - Exterior Improvements

32 1313.....	Concrete Paving
32 1373.....	Concrete Paving Joint Sealants
32 9113.....	Landscape Grading
32 9200.....	Turf and Grasses
32 9300.....	Trees, Plants, and Ground Cover

Division 33 - Utilities

33 1100.....	Water Distribution
33 3100.....	Sanitary Sewers
33 4100.....	Storm Drainage

END OF TABLE OF CONTENTS

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Public Notice

Sealed bids will be received by the Beaver Creek Township Board of Trustees for the **Fire Station No. 65 Project**. Contract Documents, which include additional details, will be available to download from App Architecture's ShareFile site. Email your request to bids@app-arch.com and a link will be sent to you with downloading instructions. The Contract Documents will also be available through Dodge Reports and the Builders Exchange of Ohio. Addenda will be issued only to those obtaining complete sets of documents.

This notice is also posted on the Township's website at <http://beavercreektownship.org/> and may be accessed by clicking, "Township Services", then "Bids and RFP's."

Bids shall be enclosed in a sealed envelope addressed to Beaver Creek Township Fire Department, ATTN: Amy Hiles, 851 Orchard Lane, Beaver Creek, OH 45434 and plainly marked on the outside "**BEAVERCREEK TOWNSHIP - FIRE STATION NO. 65 PROJECT BID.**" Bids will be received until 10:00 AM EST August 26, 2020 and read immediately thereafter from the Township Meeting Room streamed via YouTube Live.

A pre-bid meeting will be held on August 5, 2020 at 9:00 AM EST via GoToMeeting. Attendance is highly recommended.

All bids must include a Bid Guaranty, as described in the Instructions to Bidders. Prevailing wage rates do apply. No bidder may withdraw its bid within 60 days after the opening; the Township reserves the right to waive irregularities, reject any or all bids, and conduct necessary investigations to determine bidder responsibility.

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INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

A.	BIDDER'S PLEDGE AND AGREEMENT	1
B.	EXAMINATION OF CONTRACT DOCUMENTS AND SITE CONDITIONS AND RELIANCE UPON TECHNICAL DATA.....	1
C.	PROJECT	2
D.	WORK.....	2
E.	ESTIMATE OF COST.....	2
F.	CONTRACT DOCUMENTS AND PRE-BID MEETING	3
G.	PREPARATION OF BIDS	3
H.	METHOD OF AWARD	5
I.	EXECUTION OF CONTRACT	8
J.	SUBSTITUTIONS/NON-SPECIFIED PRODUCTS	8
K.	ALTERNATES.....	9
L.	UNIT PRICES.....	10
M.	ADDENDA.....	10
N.	INTERPRETATION	10
O.	STATE SALES AND USE TAXES	11
P.	DATE FOR SUBSTANTIAL COMPLETION/ DATE FOR FINAL COMPLETION /LIQUIDATED DAMAGES	11
Q.	OWNER'S RIGHT TO WAIVE DEFECTS AND IRREGULARITIES	11
R.	MODIFICATION/WITHDRAWAL OF BIDS.....	11
S.	COMPLIANCE WITH APPLICABLE LAWS	12
T.	FINDINGS FOR RECOVERY.....	12
U.	PREVAILING WAGES	12

A. BIDDER'S PLEDGE AND AGREEMENT

1. Each Bidder acknowledges that this is a public project involving public funds and that the Owner expects and requires that each successful Bidder adhere to the highest ethical and performance standards. Each Bidder by submitting a bid pledges and agrees that (a) it will act at all times with absolute integrity and truthfulness in its dealings with the Owner and the Design Professional, (b) it will use its best efforts to cooperate with the Owner and the Design Professional and all other Contractors on the Project and at all times will act with professionalism and dignity in its dealings with the Owner, Design Professional, and other Contractors, (c) it will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are assigned to him/her, and (d) it has read, understands and will comply with the terms of the Contract Documents.

B. EXAMINATION OF CONTRACT DOCUMENTS AND SITE CONDITIONS AND RELIANCE UPON TECHNICAL DATA

1. Each Bidder shall have a competent person carefully and diligently review each part of the Contract Documents, including the Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work on which the Bidder is submitting its bid. By submitting its bid, each Bidder represents and agrees, based upon its careful and diligent review of the Contract Documents, that it is not aware of any conflicts, inconsistencies, errors, or omissions in the Contract Documents for which it has not notified the Design Professional in writing at least ten (10) days prior to the bid opening. If there are any such conflicts, inconsistencies, errors, or omissions in the Contract Documents, the Bidder (i) will provide the labor, equipment, or materials of the better quality or greater quantity of Work and/or (ii) will comply with the more stringent requirements. The Bidder will not be entitled to any additional compensation for any conflicts, inconsistencies, errors, or omissions that would have been discovered by such careful and diligent review, unless it has given prior written notice to the Design Professional.
2. Each Bidder shall have a competent person carefully and diligently inspect and examine the entire site and the surrounding area, including all parts of the site applicable to the Work for which it is submitting its bid, including location, condition, and layout of the site and the location of utilities, and carefully correlate the results of the inspection with the requirements of the Contract Documents. The Bidder's bid shall include all costs attributable to site and surrounding area conditions that would have been discovered by such careful and diligent inspection and examination of the site and the surrounding area, and the Bidder shall not be entitled to any Change Order, additional compensation, or additional time on account of such conditions.
3. The Bidder may rely upon the general accuracy of any technical data identified in the Owner-Contractor Agreement (e.g., any soils exploration reports, soil boring logs, site survey, or abatement reports) in preparing its bid, but such technical data are not part of the Contract Documents. Except for the limited reliance described in the preceding sentence, Bidder may not, if awarded a contract for the Work, rely upon or make any Claim against the Owner or Design Professional, or any of their agents or employees, with respect to any of the following:
 - (a) the completeness of such reports and drawings for Bidder's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the successful Bidder and safety precautions and programs incident thereto; or

- (b) any interpretation by the successful Bidder of or conclusion drawn from any technical data or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by the Bidder to estimate locations or quantities of subsurface strata are independent factual assumptions, which Owner does not warrant.
- 4. Each Bidder will be deemed to have actual knowledge of all information provided or discussed at the pre-bid meeting.

C. PROJECT

1. The "Project" is the Fire Station No. 65 Project. The Project and Work for the Project consists of all labor, materials, equipment, and services necessary for the construction of a new three apparatus bay fire station designed to accommodate a crew of up to six fire/EMS staff. Total building area is 9,331 SF. Building is constructed of metal studs, fire retardant wood trusses, structural steel frame and concrete masonry units with brick veneer. The Project is located at 1777 Trebein Road, Beavercreek Township, Ohio 45385. The Work shall be completed in accordance with the Drawings and Specifications prepared by the Design Professional.

2. The Design Professional for the Project is:

App Architecture
615 Woodside Drive
Englewood, Ohio 45322
(937)836-8898

Design Professional's Representatives: Timothy J. Bement (tim.bement@app-arch.com)

Curt Sparks (curt.sparks@app-arch.com)

Brenda Lynn (brenda.lynn@app-arch.com)

D. WORK

1. Only one contract will be issued by the Owner for constructing the Project, the General Contract, which will cover all scopes of work necessary to construct the Project.
2. The Contractor awarded the General Contract (General Contractor) will be responsible for the performance and coordination of any and all subcontractors and suppliers either directly or indirectly contracted with the General Contractor.
3. General public access is available to the Project site located at 1777 Trebein Road, Beavercreek Township, Ohio 45385. Bidders may access the Project site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

E. ESTIMATE OF COST

1. The total estimated construction cost for the base bid is \$4,200,000.00 including allowances.
2. The estimated construction cost of the Alternates for which Owner is seeking bids is as follows:

Alternate Description		Estimated Cost
G-1	Provide all labor and materials to provide a standing seam metal roof and snow guards in lieu of asphalt shingles.	\$91,000
C-1	Deduct alternate to provide all labor and material to construct the site without the bypass driveway and include all necessary grass seeding of the area.	\$(7,500)

3. The estimated cost of the Allowances for the Project are as follows:

Allowance Description		Estimated Cost
1	Winter protection allowance to cover concrete slab with insulating blankets and temporary heat and tenting for masonry work	\$25,000

F. CONTRACT DOCUMENTS AND PRE-BID MEETING

The Contract Documents consist of the Contract Documents listed in Section 1 of the Owner-Contractor Agreement.

Contract Documents are available electronically via the design professional, App Architecture. Request an electronic copy of the Contract Documents in writing from Tim Bement at tim.bement@app-arch.com. The Contract Documents will also be available through Dodge Reports and the Builders Exchange of Ohio. Bidders shall use complete sets of Contract Documents in preparing bids. Neither the Owner nor the Design Professional assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.

The Owner or the Design Professional, in making the Contract Documents available on the above terms, does so only for the purpose of obtaining bids on the Work and does not confer a license or grant for any other use.

A pre-bid conference will be held at 9:00 AM on August 5, 2020 via GoToMeeting at <https://global.gotomeeting.com/join/184263093> or by dialing in at (646)749-3112 and entering the access code 184-263-093. Questions regarding the pre-bid meeting may be directed to Tim Bement at tim.bement@app-arch.com. It is highly recommended that the bidders attend the pre-bid conference.

G. PREPARATION OF BIDS

1. All bids must be submitted on the "Bid Form" furnished with the Contract Documents.
2. All blank spaces shall be filled in, in ink or typewritten, in words and figures, and in figures only where no space is provided for words, and signed by the Bidder. The wording on the Bid Form shall be used without change, alteration, or addition. Any change in the wording or omission of specified accompanying documents may cause the bid to be rejected. If there is an inconsistency or conflict in the bid amount, the lowest amount shall control, whether expressed in numbers or words.
3. Bidders shall note receipt of Addenda on the Bid Form. If the Bidder fails to acknowledge receipt of each Addendum, the Bid shall be deemed non-responsive, unless the Bid amount clearly and unambiguously reflects receipt of the Addendum or the Addendum involves only or is one which has either no effect or has merely a trivial or negligible effect on the price, quantity or quality of the Work to be performed.
4. Each Bidder shall submit **3** copies of its bid to the Owner. Bidders have the option to submit one electronic copy in PDF format on CD-DVD or flash drive in addition to hard copies. The

Bid Form shall be signed with the name typed or printed below the signature. A Bid shall not be submitted by facsimile transmission. A Bidder that is a corporation shall sign its bid with the legal name of the corporation followed by the name of the state of incorporation and the legal signature of an officer authorized to bind the corporation to a contract.

5. Bids shall be enclosed in a sealed opaque envelope with the Bidder's name, plainly marked on the outside **"BEAVERCREEK TOWNSHIP - FIRE STATION NO. 65 PROJECT BID,"** and addressed as follows:

**Beavercreek Township Fire Department
ATTN: Amy Hiles
851 Orchard Lane
Beavercreek, Ohio 45434**

Bids must be received at the location designated above before **10:00 AM EST, August 26, 2020**. Bids will be opened and publicly read immediately thereafter on August 26, 2020, at the Township Meeting Room streamed via YouTube live.

6. **The completed Bid Form shall be accompanied by the following documents:**

- a. **Bid Guaranty and if applicable, Contract Bond (See Paragraph G.8 below.)**
- b. **Contractor's Qualification Statement (See Paragraph H.4 below.)**

7. The Bidder shall take the following precautions in preparing its bid:

- a. Sign the bid and check to ensure all blank spaces have been filled in with requested information and that the specified accompanying documents (listed in Paragraph G.6 above) have been included in a sealed opaque envelope addressed as described in item 5 above.
- b. When the Bid Form provides for quoting either an addition or deduction for an Alternate item, indicate whether the sum named is an addition or deduction. If it is not indicated, it will be conclusively presumed that the amount is a deduction.
- c. When the Bid Form provides for quoting a unit price, the Bidder should quote the unit price as set forth in the Bid Documents.
- d. When applicable, make sure that the Bid Guaranty is properly executed and signed by:
 - 1) The Bidder
 - 2) The Surety or Sureties
- e. Make sure that the amount of the Bid Guaranty (if the Bid Guaranty is in the form of a certified check, letter of credit, or cashier's check) is for a specific sum in an amount as instructed in Paragraph G.8.a below. If the Bid Guaranty is in the form of the Bid Guaranty and Contract Bond, the amount may be left blank; if an amount is inserted, it must equal the total of the base bid and all add alternates included. If inserted, then the failure to state an amount equal to the total of the base bid and all add alternates shall make the bid non-responsive if the Owner selects alternates not included in the amount.
- f. Make sure that the appropriate bid package and scope of work is inserted in the correct space on the Bid Guaranty and Contract Bond Form. Failure to include work covered by the bid submitted may make the bid non-responsive.

8. Bonds and Guarantees

- a. Bid Guaranty: Bidder shall furnish a Bid Guaranty, in the form prescribed in Sections 153.54, 153.57, and 153.571 of the Ohio Revised Code, in the form of either: (1) a bond for the full amount of the bid in the form of the Bid Guaranty and Contract Bond included in the Bid Documents; or (2) a certified check, cashier's check, or irrevocable letter of credit in a form satisfactory to the Owner in an amount equal to 10% of the bid. Bid amount shall be the total of all sums bid, including all add alternatives, but excluding all deduct alternatives. NOTE: AIA Bid Bond forms are not acceptable.
- b. Contract Bond: The successful Bidder, who, as a Bid Guaranty, submits a certified check, cashier's check, or irrevocable letter of credit in an amount equal to 10% of the bid, shall furnish a Contract Bond in the form Contract Bond included in the Bid Documents in an amount equal to 100% of the Contract Sum. NOTE: AIA Bond forms are not acceptable.
- c. The bond must be issued by a surety company authorized by the Ohio Department of Insurance to transact business in the State of Ohio and acceptable to the Owner. The bond must be issued by a surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. These criteria will be deemed to be met if the surety currently has an A.M. Best Company Policyholders Rating of "A-" or better and has or exceeds the Best Financial Size Category of Class VI. Other sureties may be acceptable to the Owner, in its sole discretion
- d. All bonds shall be signed by an authorized agent of an acceptable surety and by the Bidder.
- e. Surety bonds shall be supported by credentials showing the Power of Attorney of the agent, a certificate showing the legal right of the Surety Company to do business in the State of Ohio, and a financial statement of the Surety.
- f. The Bid Guaranty, as applicable, shall be in the name of or payable to the order of the Owner.
- g. The name and address of the Surety and the name and address of the Surety's Agent should be typed or printed on each bond.

H. METHOD OF AWARD

1. All bids shall remain open for acceptance for sixty (60) days following the day of the bid opening, but the Owner may, in its sole discretion, release any bid and return the Bid Guaranty prior to that date. The Bid Guaranty shall be subject to forfeiture, as provided in the Ohio Revised Code, if a bid is withdrawn during the period when bids are being held.
2. The Owner reserves the right to reject any, part of any, or all bids and to waive any informalities and irregularities. The Bidder expressly acknowledges this right of the Owner to reject any or all bids or to reject any incomplete or irregular bid. Bidders must furnish all information requested on or accompanying the Bid Form. Failure to do so may result in disqualification of the bid.
3. Determination of the Lowest and Best Bid. Subject to the right of the Owner to reject any or all bids, the Owner will award the Contract for the Work to the responsible bidder submitting the lowest and best bid, taking into consideration accepted alternates. In evaluating bids, the Owner may consider the qualifications of the Bidders, whether or not the bids comply with the prescribed requirements, and alternates and unit prices, if requested, on the Bid Form. **When determining the lowest and best bid, the Township will give strong consideration to a Bidder's experience with projects of a similar nature, budget, and complexity, including Ohio public projects. Bidders will list all such projects**

completed in the past 10 years and describe such experience in detail in their qualifications. The Owner may also consider the qualifications and experience of subcontractors and suppliers. The Owner may conduct such investigations as are deemed necessary to establish the qualifications and financial ability of the Bidder and its subcontractors and suppliers. The factors the Owner may consider in determining which bid is lowest and best include the factors set forth below. The Owner, in its discretion, may consider and give such weight to these criteria as it deems appropriate.

- a. The Bidder's work history. The Bidder should have a record of consistent customer satisfaction and of consistent completion of projects, including projects that are comparable to or larger and more complex than the Owner's Project, on time and in accordance with the applicable Contract Documents, and the Bidder's claims history. If the Bidder's management operates or has operated another construction company, the Owner may consider the work history of that company in determining whether the Bidder submitted the lowest and best bid.

The Owner will consider the Bidder's prior experience on other projects of similar scope and/or complexity including prior projects with the Owner and/or Design Professional, including the Bidder's demonstrated ability to complete its work on these projects in accordance with the Contract Documents and on time, and will also consider its ability to work with the Owner and Design Professional as a willing, cooperative, and successful team member. Bringing overstated claims, an excessive number of claims, acting uncooperatively, and filing lawsuits against project owners and/or their design professionals on prior projects of similar scope and/or complexity will be deemed evidence of a Bidder's inability to work with the Owner and Design Professional as a willing, cooperative, and successful team member.

The Bidder authorizes the Owner and its representatives to contact the owners and design professionals (and construction managers, if applicable) on projects on which the Bidder has worked and authorizes and requests such owners and design professionals (and construction managers) to provide the Owner with a candid evaluation of the Bidder's performance. By submitting its bid, the Bidder agrees that if it or any person, directly or indirectly, on its behalf or for its benefit brings an action against any of such owners or design professionals (or construction managers) or the employees of any of them as a result of or related to such candid evaluation, the Bidder will indemnify and hold harmless such owners, design professionals (and construction managers) and the employees of any of them from any claims whether or not proven that are part of or are related to such action and from all legal fees and expenses incurred by any of them arising out of or related to such legal action. This obligation is expressly intended for the benefit of such owners, design professionals (and construction managers), and the employees of each of them.

- b. The Bidder's financial ability to complete the Contract successfully and on time without resort to its Surety.
- c. The Bidder's prior experience with similar work on comparable or more complex projects, especially work performed for Beaver Creek Township.
- d. The Bidder's prior history for the successful and timely completion of projects, including the Bidder's history of filing claims and having claims filed against it.
- e. The Bidder's equipment and facilities.
- f. The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time.
- g. The Bidder's compliance with federal, state, and local laws, rules, and regulations, including but not limited to the Occupational Safety and Health Act, the Ohio Prevailing Wage laws, and Ohio ethics laws.

- h. The foregoing information with respect to each of the Subcontractors and Suppliers that the Bidder intends to use on the Project.
 - i. The Bidder's participation in a drug-free workplace program acceptable to the Owner, and the Bidder's record for both resolved and unresolved findings of the Auditor of State for recovery as defined in Section 9.24 of the Ohio Revised Code.
 - j. The Owner's prior experience with the Bidder's surety.
 - k. The Bidder's interest in the Project as evidenced by its attendance at any pre-bid meetings or conferences for bidders.
 - l. The Bidder's proposed Date for Substantial Completion in calendar days from Date of Commencement.
 - m. Depending upon the type of the work, other essential factors, as the Owner may determine and as are included in the Specifications.
4. **Qualifications Statement.** Each Bidder will submit with its bid a completed Contractor's Qualifications Statement, which is included with the Contract Documents, and thereafter provide the Design Professional promptly with such additional information as the Design Professional may request regarding the Bidder's qualifications. **In their Contractor's Qualifications Statement, Bidders must list all projects of a similar nature, budget, and complexity, to this Project, with an emphasis on Ohio public projects completed in the past 5 years and describe such experience in detail.** A Bidder shall submit any requested additional information within three (3) business days of the date on the request.
5. The failure to submit requested information on a timely basis may result in the determination that the Bidder has not submitted the lowest and best bid.
6. By submitting its bid, the Bidder agrees that the Owner's determination of which bidder is the lowest and best bidder shall be final and conclusive, and that if the Bidder or any person on its behalf challenges such determination in any legal proceeding, the Bidder will indemnify and hold the Owner and its employees and agents harmless from any claims included or related to such legal proceeding, whether or not proven, and from legal fees and expenses incurred by the Owner, its employees, or agents that arise out of or are related to such challenge.
7. **After bid opening, within three (3) business days of a request made by the Owner or Design Professional, the apparent low Bidder and any other Bidder so requested must submit the following:**
- a. **For all subcontracts with an estimated value of at least \$20,000, a list of all Subcontractors that the Bidder will use to construct the Project, as well as an indication of whether or not the Bidder has ever worked with a proposed Subcontractor before, including the following information for the three most recent projects on which the Bidder and each Subcontractor have worked together:**
 - i. **Project Owner**
 - ii. **Project Name**
 - iii. **Subcontract Scope**
 - iv. **Subcontract Value**
 - v. **Owner's contact name and phone number.**

If Bidder and a proposed Subcontractor have not worked together on at least three projects in the five years, Bidder must submit the information set forth above for the three most recent similar projects to the Project that a proposed Subcontractor has worked on.

The above Subcontractor information, as well as the information pertaining to each proposed Subcontractor, shall be used in the Owner's determination of the lowest and best bid.

Once a Bidder identifies its proposed Subcontractors as set forth herein, and Owner makes no objections, the list shall not be changed unless written approval of the change is authorized by the Owner and Design Professional.

8. Affidavit as to Personal Property Taxes. Each successful Bidder shall submit, prior to the time of the entry into the Contract, an affidavit in the form required by Section 5719.042, Ohio Revised Code, regarding the status of the Bidder's personal property taxes. A copy of the affidavit form is included with the Contract Documents.
9. No Bidder may withdraw its bid within sixty (60) days after the date bids are opened. The Owner reserves the right to waive any formalities or irregularities or to reject any or all bids.
10. The Owner reserves the right to disqualify bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices on the part of the Bidder.
11. Award of Contract. The award of the Contract, when required, will only be made pursuant to a duly adopted resolution of the Owner.

I. EXECUTION OF CONTRACT

1. Within the time designated by the Design Professional after award of the Contract, the successful Bidder shall execute and deliver to the Design Professional the required number of copies of the Owner-Contractor Agreement, in the form included in the Contract Documents, and all accompanying documents requested, including, but not limited to, a Contract Bond (if applicable), insurance certificates, and a valid Workers' Compensation Certificate. The successful Bidder shall have no property interest or rights under the Owner-Contractor Agreement until the Agreement is executed by the Owner.

J. SUBSTITUTIONS/NON-SPECIFIED PRODUCTS

1. Certain brands of material or apparatus are specified. Each bid will be based on these brands, which may be referred to in the Contract Documents as Standards. The use of another brand (referred to as a substitution or proposed equal in the Contract Documents, when a bidder or the contractor seeks to have a different brand of material or apparatus than that specified approved by the Owner for use in the Project) may be requested as provided herein. Substitutions, however, will not be considered in determining the lowest and best bid.
2. The products specified in the Contract Documents establish a standard of required function, dimension, appearance, and quality.
3. Bidders wishing to obtain approval to bid non-specified products shall submit written requests to the Design Professional a minimum of seven working days before the bid date and hour. To facilitate the submission of requests, a Pre-Bid Substitution Form is included in the Contract Documents. The Bidder shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution, including the name of the proposed manufacturer and/or product and a complete description of the proposed product including manufacturer's name and model number or system proposed, drawings, product literature, performance and test data, color selections or

limitations, and any other information necessary for evaluation. Include a statement including any changes in other materials, equipment, or other work that would be required if the proposed product is incorporated in the materials, equipment, or other work that would be required if the proposed product is incorporated in the work. The burden of proof of the merit of the proposed product is on the proposer. The Design Professional's decision on approval of a proposed product will be final.

The following will be cause for rejection of a proposed substitution:

- a. Requests submitted by subcontractors, material suppliers, and individuals other than Bidders;
 - b. Requests submitted without adequate documentation;
 - c. Requests received after the specified cut-off date.
4. When the Design Professional approves a product submission before receipt of bids, the approval will be included in an Addendum, and Bidders may include the pricing of this product in their bid. Bidders shall not rely on approvals made in any other manner.
 5. In proposing a non-specified product or a substitution, the Bidder represents and warrants that each proposed product will not result in any changes to the Project, including changes to the Work of other contractors, or any decrease in the performance of any equipment or systems to be installed in the Project and agrees to pay any additional costs incurred by the Owner and the Owner's consultants as a result of a non-specified or substitute product that is accepted.
 6. Following the award of the Contract, there shall be no substitutions for specified products, except pursuant to a Change Order. The Owner in its sole discretion may decline to consider a substitution for a Change Order.

K. ALTERNATES

1. The Owner may request bids on alternates. If the Owner requests bids on alternates, the Bidder should include the cost of the alternates requested on its Bid Form.
2. At the time of awarding the contract, the Owner will select or reject alternates as it determines is in its best interest. A Bidder's failure to include on its Bid Form the cost of an alternate selected by the Owner and applicable to the Bidder's work shall render the bid non-responsive and be grounds for the rejection of the bid. Otherwise, the failure to include the cost of an alternate will not be deemed material.
3. The Bidder acknowledges that although there is an estimate for the cost of the Project, the market conditions may and frequently do result in the estimate being different from the sum of the bids received, either higher or lower. The Bidder understands that the Owner may include alternates, which may include deduct alternates as well as add alternates, to give it flexibility to build the Project with the funds available. The Bidder further understands and acknowledges that use of add and deduct alternates is a long held customary practice in the construction industry in the State of Ohio. The Bidder also acknowledges that the Owner will not make a decision about the alternates on which to base the award of contracts until the bids are received, and the Owner can compare its available funds with the base bids and the cost or savings from selecting different alternates. The Bidder understands that the award to the Bidder submitting the lowest and best bid will be based on the lowest base bid plus selected alternates, and may result in an award to a Bidder other than the Bidder that submitted the lowest base bid.
4. If, during the progress of the Work, the Owner desires to reinstate any alternate not included in the Contract, the Owner reserves the right to reinstate the alternate at the price bid by the

Contractor provided that such action is taken in sufficient time so as not to delay the progress of the work or cause the Contractor additional expense.

L. UNIT PRICES

1. Where unit prices are requested in the Bid Form the Bidder should quote a unit price. Unless otherwise expressly provided in the Bid Documents, such unit prices shall include all labor, materials, and services necessary for the timely and proper installation of the item for which the unit prices are requested. Where the applicable work is directed by the Design Professional, the unit prices quoted in the bid shall be the basis for any Change Orders entered into under the Owner-Contractor Agreement, unless the Design Professional determines that the use of such unit prices will cause substantial inequity to either the Contractor or the Owner.

M. ADDENDA

1. The Owner reserves the right to issue Addenda changing, altering, or supplementing the Contract Documents prior to the time set for receiving bids. The Design Professional will issue the Addenda to clarify bidders' questions and/or to change, alter, or supplement the Contract Documents.
2. Any explanation, interpretation, correction, or modification of the Contract Documents will be issued in writing in the form of an Addendum, which shall be the only means considered binding; explanations, interpretations, etc., made by any other means shall NOT be legally binding. All Addenda shall become a part of the Contract Documents.
3. Bidders shall submit written questions to the Design Professional in sufficient time in advance of the bid opening to allow sufficient time for the Design Professional to respond. All Addenda will be issued, except as hereafter provided, and e-mailed or otherwise furnished to persons who have obtained Contract Documents for the Project, at least seventy-two (72) hours prior to the published time for the opening of bids, excluding Saturdays, Sundays, and legal holidays. If any Addendum is issued within such seventy-two (72) hour period, then the time for opening of bids shall be extended one (1) week with no further advertising of bids required.
4. Copies of each Addendum will be sent only to the Bidders to whom Contract Documents have been issued and to Plan Rooms where copies of the Contract Documents are maintained. Receipt of Addenda shall be indicated by Bidders in the space provided on the Bid Form. Bidders are responsible for acquiring issued Addenda in time to incorporate them into their bid. Bidders should contact the Design Professional prior to the bid opening to verify the number of Addenda issued.
5. Each Bidder shall carefully read and review the Contract Documents and immediately bring to the attention of the Design Professional any error, omission, inconsistency, or ambiguity therein.
6. If a Bidder fails to indicate receipt of all Addenda through the last Addendum issued by the Design Professional on its Bid Form, the bid of such Bidder will be deemed to be responsive only if:
 - a. The bid received clearly indicates that the Bidder received the Addendum, such as where the Addendum added another item to be bid upon and the Bidder submitted a bid on that item; or
 - b. The Addendum involves only a matter of form or is one which has either no effect or has merely a trivial or negligible effect on price, quantity, quality, or delivery of the item bid upon.

N. INTERPRETATION

1. If a Bidder contemplating submitting a bid for the proposed Project is in doubt as to the true meaning of any part of the Contract Documents, it may submit a written request for an interpretation thereof to Tim Bement at tim.bement@app-arch.com. Only e-mail correspondence is permitted. All such requests must be received on or before **August 19, 2020**, requests received after August 19, 2020 may not be answered. Any interpretation of the proposed documents will be made by Addendum only, duly signed by the Design Professional, and a copy of such Addendum will be sent electronically to each Bidder receiving a complete set of Contract Documents and each plan room where the Contract Documents are maintained. The Owner will not be responsible for any other explanation or interpretation of the proposed documents.
2. In interpreting the Contract Documents, words describing materials that have a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with the well-known meaning recognized by the trade.
3. Bidders are responsible for notifying the Owner and the Design Professional in a timely manner of any ambiguities, inconsistencies, errors, or omissions in the Contract Documents. The Bidder shall not, at any time after the execution of the Contract, be compensated for a claim alleging insufficient data, incomplete Contract Documents, or incorrectly assumed conditions regarding the nature or character of the Work, if no request was made by the Bidder prior to the bid opening.

O. STATE SALES AND USE TAXES

1. The Owner is a political subdivision of the State of Ohio and is exempt from taxation under the Ohio Sales Tax and Use Tax Laws. Building materials that the successful Bidder purchases for incorporation into the Project will be exempt from state sales and use taxes if the successful Bidder provides a properly completed Ohio Department of Taxation Construction Contract Exemption Certificate to the vendors or suppliers when the materials are acquired. The Owner will execute properly completed certificates on request.

P. DATE FOR SUBSTANTIAL COMPLETION/ DATE FOR FINAL COMPLETION /LIQUIDATED DAMAGES

1. The Date for Substantial Completion (aka Contract Time), Date for Final Completion, and Liquidated Damages shall be as defined and set forth in the Owner-Contractor Agreement. **By submitting its Bid, each Bidder agrees that the period for performing its Work in the time the Bidder proposed is reasonable.**

Q. OWNER'S RIGHT TO WAIVE DEFECTS AND IRREGULARITIES

1. The Owner reserves the right to waive any and all irregularities provided that the defects and irregularities do not affect the amount of the bid in any material respect or otherwise give the Bidder a competitive advantage.

R. MODIFICATION/WITHDRAWAL OF BIDS

1. Modification. A Bidder may modify its bid by written communication to the Owner addressed to the Owner's Representative at any time prior to the scheduled closing time for receipt of bids, provided such written communication is received by Owner's Representative prior to the bid deadline. The written communication shall not reveal the bid price, but should provide the addition or subtraction or other modification so that the final prices or terms will not be known until the sealed bid is opened. If the Bidder's written instructions with the change in bid reveal the bid amount in any way prior to the bid opening, the bid may be rejected as non-responsive.
2. Withdrawal Prior to Bid Deadline. A Bidder may withdraw its bid at any time for any reason prior to the bid deadline for the opening of bids established in the Request for Bids. The

request to withdraw shall be made in writing to and received by the Owner's Representative prior to the time of the bid opening.

3. Withdrawal after Bid Deadline.

- a. All bids shall remain valid and open for acceptance for a period of at least 60 days after the bid opening; provided, however, that a Bidder may withdraw its bid from consideration after the bid deadline when all of the following apply:
 - (1) the price bid was substantially lower than the other bids;
 - (2) the reason for the bid being substantially lower was a clerical mistake, rather than a mistake in judgment, and was due to an unintentional and substantial error in arithmetic or an unintentional omission of a substantial quantity of work, labor, or material;
 - (3) the bid was submitted in good faith; and
 - (4) the Bidder provides written notice to the Owner, to the attention of the Owner's Representative, within two (2) business days after the bid opening for which the right to withdraw is claimed.
- b. No bid may be withdrawn under this provision if the result would be the awarding of the contract on another bid for the bid package from which the Bidder is withdrawing its bid to the same Bidder.
- c. If a bid is withdrawn under this provision, the Owner may award the Contract to another Bidder determined by the Owner to be the lowest and best bidder or the Owner may reject all bids and advertise for other bids. In the event the Owner advertises for other bids, the withdrawing Bidder shall pay the costs incurred in connection with the rebidding by the Owner, including the cost of printing new Contract Documents, required advertising, and printing and mailing notices to prospective bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.

S. COMPLIANCE WITH APPLICABLE LAWS

1. By submitting a bid for Work on the Project, the Bidder acknowledges that it is in compliance with applicable federal, state, and local laws and regulations, including, but not limited to, the following:
 - a. Equal Employment Opportunity/Nondiscrimination. The Bidder agrees that if it is awarded a contract that in the hiring of employees for performance of work under the contract or any subcontract, neither it nor any subcontractor, or any person acting on its behalf or its subcontractor's behalf, by reason of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who are qualified and available to perform work to which the employment relates. The Bidder further agrees that neither it nor any subcontractor or any person on its behalf or on behalf of any subcontractor, in any manner, shall discriminate against or intimidate any employees hired for the performance of the work under the contract on account of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color.
 - b. Ethics Laws. The Bidder represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements.

T. FINDINGS FOR RECOVERY

1. By submitting its bid, each Bidder certifies for reliance of the Owner that it has no unresolved finding for recovery against it issued by the Auditor of the State of Ohio on or after January 1, 2001, except as permitted by Section 9.24 (F) of the Ohio Revised Code.

U. PREVAILING WAGES

1. The successful Bidder and all of its subcontractors, regardless of tier, will strictly comply with its obligation to pay a rate of wages on the Project not less than the rate of wages fixed for this Project under Section 4115.04 of the Ohio Revised Code. Additionally, the successful Bidder will comply with all other provisions of Chapter 4115 of the Ohio Revised Code.

END OF INSTRUCTIONS TO BIDDERS

OWNER-CONTRACTOR AGREEMENT

Owner:

Beavercreek Township Board of Trustees
851 Orchard Lane
Beavercreek, Ohio 45434

Owner's Representative(s):

Amy Hiles (ahiles@beavercreektownship.org) and
Nathan Heister (nhiester@beavercreektownship.org)

Project:

Fire Station No. 65 Project
Located at:
1777 Trebein Road
Beavercreek Township, Ohio 45385

Contractor:

Contractor's Representative(s):

Contract: General

Accepted Alternates: _____

This document is an agreement between the Owner and the Contractor for the Work described in the Contract Documents related to the Contract identified above for the Project defined above and is effective as of the date the Agreement is signed by the Owner (the "Effective Date").

The Owner and the Contractor agree as set forth in the following sections:

1. **CONTRACT DOCUMENTS.** The Contract Documents consist of the following documents:
 - A. Legal Notice;
 - B. Instructions to Bidders;
 - C. Bid Form;
 - D. Owner-Contractor Agreement;
 - E. General Conditions of the Contract for Construction (AIA Document A201-2017), as modified;
 - F. Drawings and Specifications prepared by App Architecture, titled "Beavercreek Township Fire Station #65" and dated: Project Manual: July 28, 2020, Drawings: April 3, 2020
 - G. Bid Guaranty and Contract Bond
 - H. Addenda issued;
 - I. Contractor's Personal Property Tax Affidavit (O.R.C. 5719.042);
 - J. Statement of Claim Form; and
 - K. Modifications issued after the execution of the contract, including:
 - i. A Change Order;
 - ii. A Work Change Directive; or,
 - iii. A written order for a minor change of the Work issued by the Design Professional in accordance with the General Conditions.
 - L. Prevailing Wage Rates

- 1.1 Notwithstanding anything in the Contract Documents to the contrary, in the event of any inconsistency, the provisions of this Agreement shall control over any other Contract Document, proposal, document, or other attachment. In the event inconsistencies, conflicts, or ambiguities between or among the Contract Documents are discovered after execution of the Agreement, Contractor shall provide the better quality or greater quantity of Work or comply with the more stringent requirements.

Note: Non-Contract Documents. The following are the reports and tests of subsurface conditions at or contiguous to the Site, if any, that the Design Professional has used in preparing

the Contract Documents. These are not Contract Documents. Geotechnical data is not a warranty of subsurface conditions and is not to be relied upon as a complete representation of all possible soil conditions. Neither Owner nor its consultants warrant the accuracy of the geotechnical data. It is possible that there may be other reports, and/or tests of subsurface conditions at or contiguous to the Site not prepared by or on behalf of Owner. The Owner makes no representation about such reports and/or tests, assuming they exist. Additional information, if needed by Contractor for geotechnical data or site survey, shall be obtained by the Contractor at no additional cost to Owner. The General Conditions, as modified, contain additional terms related to these reports and tests.

Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings listed below, and except for such reliance on "technical data," Contractor shall not rely upon or make any claim against Owner or Architect with respect to: (1) the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or (2) other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or (3) any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by Contractor to estimate locations or quantities of subsurface strata are independent factual assumptions which Owner does not warrant.

Geotechnical Exploration Report, Dated April 10, 2018

Note: Non-Contract Documents. The following are those reports and drawings related to any Hazardous Conditions at the Site, if any. These are not Contract Documents. The General Conditions, as modified, contain additional terms related to these reports and drawings. (None if none are listed).

2. **DESIGN PROFESSIONAL RELATIONSHIP.** The Contract Documents shall not be construed to create a contractual relationship of any kind between the Design Professional and the Contractor or any Subcontractor or Material Supplier to the Project. The Design Professional, however, shall be entitled to performance of the obligations of the Contractor intended for its benefit and to enforcement of such obligations, but nothing contained herein shall be deemed to give the Contractor or any third party any claim or right of action against the Design Professional that does not otherwise exist without regard to this Contract. The Contractor and its Subcontractors shall not be deemed to be beneficiaries of any of the acts or services of the Design Professional that are performed for the sole benefit of the Owner. The Contractor shall forward all communications to the Owner through the Design Professional and hereby acknowledges and agrees that any instructions, reviews, advice, approvals, orders, or directives that are rendered to it by the Design Professional are specifically authorized and directed by the Owner to the Contractor through the Design Professional acting on behalf of the Owner.

2.1 The Design Professional is:

App Architecture
Representative: Timothy J. Bement
615 Woodside Drive
Englewood, Ohio 45322
(937)836-8898
tim.bement@app-arch.com

3. **TIME FOR COMPLETION AND PROJECT COORDINATION.**

3.1 **DATE OF COMMENCEMENT.** The date of commencement of the Work shall be the date identified as the "Date of Commencement" in the Notice to Proceed issued by the Owner, or by the

Owner through the Design Professional, to the Contractor, or if there is no Notice to Proceed, the Effective Date of this Agreement.

3.2 DATE FOR SUBSTANTIAL COMPLETION. The Project and Work for the Project consists of all labor, materials, equipment, and services necessary for construction of the Project, all in accordance with the Drawings and Specifications prepared by the Design Professional. The Contractor shall achieve Substantial Completion of its Work on the Project, as defined in the General Conditions, with [REDACTED] calendar days of the Date of Commencement ("Date for Substantial Completion").

3.2.1 DATE FOR FINAL COMPLETION. The Contractor shall achieve Final Completion of its Work on the Project, as defined the General Conditions within [REDACTED] calendar days of achieving Substantial Completion ("Date for Final Completion").

3.2.2 SHUTDOWN DATES. Due to events scheduled by the Owner and/or other Owner considerations, Contractor will not be able to perform Work on the Project on the dates listed below (none, if none are listed.) Contractor's Construction Schedule for performing the Work shall account for Contractor not being able to perform Work on these dates and the contractual dates for Substantial Completion and Final Completion will not be changed due to Contractor not being able to perform Work on these dates.

None.

3.2.3 UTILITIES AND OPERATIONS. Contractor shall not interrupt utilities to facilities or existing operations without prior written notice and approval by Owner.

3.3 CONSTRUCTION SCHEDULE. The Construction Schedule shall be developed by the Contractor as provided in the Contract Documents.

3.4 LIQUIDATED DAMAGES. If the Contractor does not have its Work on the Project Substantially Complete by the specified Date for Substantial Completion or Finally Complete by the Date for Final Completion, the Contractor shall pay the Owner (and the Owner may set off from sums coming due the Contractor) Liquidated Damages in the per diem amounts as set forth in the following tables, whichever may be applicable. "Contract Amount" of the Work will be determined by totaling the cost of all line items of Work, as set forth in the Schedule of Values.

LIQUIDATED DAMAGES – DATE FOR SUBSTANTIAL COMPLETION

<u>Original Contract Amount</u>	<u>Dollars Per Day</u>
\$1.00 to \$500,000.00	\$ 250.00
\$500,000.01 to \$2,000,000.00	\$ 500.00
\$2,000,000.01 to \$10,000,000.00	\$ 800.00
\$10,000,000.01 to \$50,000,000.00	\$ 1,500.00
\$50,000,000.01 and greater	\$ 2,000.00

LIQUIDATED DAMAGES – DATE FOR FINAL COMPLETION

<u>Original Contract Amount</u>	<u>Dollars Per Day</u>
\$1.00 to \$500,000.00	\$ 200.00
\$500,000.01 to \$2,000,000.00	\$ 250.00
\$2,000,000.01 to \$10,000,000.00	\$ 325.00
\$10,000,000.01 to \$50,000,000.00	\$ 500.00
\$50,000,000.01 and greater	\$ 625.00

The Contractor acknowledges that such amounts of Liquidated Damages represent a reasonable estimate of the actual damages for loss of or interference with the intended use of the Project that the

Owner would incur if the Contractor's Work is not Substantially Complete by its Date for Substantial Completion or Finally Complete by the required Date for Final Completion.

3.5 **INITIAL DECISION MAKER.** The Initial Decision Maker renders initial decisions on Claims in accordance with the claims process set forth in the General Conditions. The Initial Decision Maker shall be the Design Professional, unless a different Initial Decision Maker is identified below:

4. **CONTRACT SUM (also called Contract Price).** The Contract Sum to be paid by the Owner to the Contractor, as provided herein, for the satisfactory performance and completion of the Work and all of the duties, obligations, and responsibilities of the Contractor under this Agreement and the other Contract Documents is Dollars and no Cents (\$), subject to adjustment as set forth in the Contract Documents. The Contract Sum includes Allowances, Accepted Alternates, and all federal, state, county, municipal, and other taxes imposed by law, including but not limited to any sales, use, commercial activity, and personal property taxes payable by or levied against the Contractor on account of the Work or the materials incorporated into the Work. The Contractor will pay any such taxes. The Contract Sum includes the following:

4.1 Base Bid Amount: \$ (Lump Sum Bid); and

4.2 Accepted Alternates, included in the Contract Sum:

Alternate No.	Description	Amount
G-1	Provide all labor and materials to provide a standing seam metal roof and snow guards in lieu of asphalt shingles.	
C-1	Deduct alternate to provide all labor and material to construct the site without the bypass driveway and include all necessary grass seeding of the area.	

4.3 Allowances included in the Contract Sum:

Allowance Description		Amount
1	Winter protection allowance to cover concrete slab with insulating blankets and temporary heat and tenting for masonry work	

4.4 Unit Price - If there are undercuts directed by the Design Professional, such Work will be paid for in accordance with the Unit Prices bid and identified below:

Unit Price Description		Unit Price in Words	Unit Price in Figures
No. 1	Removal of unsatisfactory soil material and replace with satisfactory fill	<u> </u> Dollars per <u> </u>	\$ <u> </u> per <u> </u>
No. 2	Rock excavation and replacement with satisfactory soil material	<u> </u> Dollars per <u> </u>	\$ <u> </u> per <u> </u>
No. 3	Removal of unsatisfactory soil and replacement with low-strength concrete (1sm or clsm)	<u> </u> Dollars per <u> </u>	\$ <u> </u> per <u> </u>
No. 4	Provide and place lime for the purpose of drying wet soils	<u> </u> Dollars per <u> </u>	\$ <u> </u> per <u> </u>
No. 5	Provide and place 304 gravel	<u> </u> Dollars per <u> </u>	\$ <u> </u> per <u> </u>

4.5 If after Substantial Completion of its Work, the Contractor fails to submit its final payment application with all the documents required to be submitted with such application within ninety (90) days after written notice to do so from the Owner and without prejudice to any other rights and remedies the Owner may have available to it, the balance of the Contract Sum shall become the Owner's sole and exclusive property, and the Contractor shall have no further interest in or right to such balance.

5. **RETAINAGE.** Retainage applicable to the Contract by Ohio Revised Code Sections 153.12, .13, and .14 will be withheld as defined in the Modified General Conditions. The Contractor agrees that the financial institution selected by the Owner for deposit of retained funds is acceptable to the Contractor and will sign any documents requested related to said account.

6. **[NOT USED.]**

7. **GENERAL.**

7.1 **MODIFICATION.** No modification or waiver of any of the terms of this Agreement or of any other Contract Documents will be effective against a party unless set forth in writing and signed by or on behalf of a party. In the case of the Owner, the person executing the modification or waiver must have express authority to execute the Modification on behalf of the Owner pursuant to a resolution that is duly adopted by the Owner. Under no circumstances will forbearance, including the failure or repeated failure to insist upon compliance with the terms of the Contract Documents, constitute a waiver or modification of any such terms. The parties acknowledge that no person has authority to modify this Agreement or the other Contract Documents or to waive any of its or their terms, except as expressly provided in this section.

7.2 **ASSIGNMENT.** The Contractor may not assign this Agreement without the written consent of the Owner, which the Owner may withhold in its sole discretion.

7.3 **LAW AND JURISDICTION.** All questions regarding the validity, intention, or meaning of this Agreement or any modifications of it relating to the rights and obligation of the parties will be construed and resolved under the laws of the State of Ohio. Any suit, which may be brought to enforce any provision of this Agreement or any remedy with respect hereto, shall be brought in the Common Pleas Court of the county in which the Project is located and each party hereby expressly consents to the exclusive jurisdiction of such court to the exclusion of any other court, including any U.S. District Court or any other federal court.

7.4 **CONSTRUCTION.** The parties acknowledge that each party has reviewed this Agreement and the other Contract Documents and entered into this Agreement as a free and voluntary act. Accordingly, the normal rule of construction to the effect that any ambiguities are to be resolved against the drafting party will not be employed in the interpretation of this Agreement, the other Contract Documents, or any amendments or exhibits to it or them.

7.5 **APPROVALS.** Except as expressly provided herein, the approvals and determinations of the Owner and Design Professional will be subject to the sole discretion of the respective party and be valid and binding on the Contractor, provided only that they be made in good faith, i.e., honestly. If the Contractor challenges any such approval or determination, the Contractor has the burden of proving that it was not made in good faith by clear and convincing evidence.

7.6 **PARTIAL INVALIDITY.** If any term or provision of this Agreement is found to be illegal, unenforceable, or in violation of any laws, statutes, ordinances, or regulations of any public authority having jurisdiction, then, notwithstanding such term or provision, this Agreement will remain in full force and effect and such term will be deemed stricken; provided this Agreement will be interpreted, when possible, so as to reflect the intentions of the parties as indicated by any such stricken term or provision.

7.7 **COMPLIANCE WITH LAWS AND REGULATIONS.** The Contractor, at its expense, will comply with all applicable federal, state, and local laws, rules, and regulations applicable to the Work, including but not limited to Chapter 4115 of the Ohio Revised Code and Sections 153.59 and 153.60 of the Ohio Revised Code, which prohibit discrimination in the hiring and treatment of employees, with respect to which the Contractor agrees to comply and to require its subcontractors to comply.

7.7.1 NON-DISCRIMINATION. Contractor agrees:

- .1 That in the hiring of employees for the performance of Work under this Agreement or in any subcontract, neither the Contractor, subcontractor, or any person acting on behalf of either of them, shall by reason of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color discriminate against any citizen of the state in the employment of labor or workers who are qualified and available to perform the Work to which the employment relates.
- .2 That neither the Contractor, subcontractor, nor any person acting on behalf of either of them shall, in any manner, discriminate against or intimidate any employee hired for the performance of Work under this Agreement on account of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color.
- .3 That there shall be deducted from the amount payable to the Contractor by the Owner under this Agreement a forfeiture of twenty-five dollars (\$25.00) as required by Ohio Revised Code Section 153.60 for each person who is discriminated against or intimidated in violation of this Agreement.
- .4 That this Agreement may be canceled or terminated by the Owner and all money to become due hereunder may be forfeited for a second or subsequent violation of the terms of this section of this Agreement.

7.7.2 PREVAILING WAGE RATES. The Contractor and its subcontractors, regardless of tier shall strictly comply with their obligation to pay their employees working on the Project site at the applicable prevailing wage rates for the type of work, including any changes thereto, pursuant to Ohio Revised Code Chapter 4115.

7.7.3 ETHICS. By signing and entering into this agreement with the Owner, the Contractor represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements. The Contractor understands that failure to comply with the ethics laws is, in itself, grounds for termination of this contract and may result in the loss of other contracts with the Owner.

7.8 JOB MEETINGS. The Contractor or one of its representatives with authority to bind the Contractor will attend all job meetings. The Owner anticipates that job meetings will be scheduled on a bi-weekly basis during construction or as needed. The Contractor will ensure that its Subcontractors also hold regular job meetings at which safety issues and job matters are discussed as these relate to the Work being performed. Job meetings include, but are not limited to, pre-construction meetings, weekly job meetings, weekly safety tool box meetings, and monthly safety meetings.

7.9 PROPERTY TAX AFFIDAVIT. The Contractor's affidavit given under Section 5719.024, Ohio Revised Code, is incorporated herein.

7.10 PARTNERING. Contractor agrees that it will participate, as part of the Contract Sum, in any partnering sessions scheduled by the Owner.

7.11 WARRANTIES. Notwithstanding anything to the contrary in the Contract Documents, including the Project Manual, Drawings, and Specifications, no warranties by Contractor shall be limited to any time shorter than the statute of limitations for written contracts in Ohio.

7.12 CONTRACTOR ATTESTATIONS.

7.12.1 Contractor attests that it has not scaled these contract documents to determine quantities for bids, as Contractor has field verified and taken its own dimensions to determine the quantities for its bid.

7.12.2 Contractor agrees that all the scales noted on the drawings are correct; so as to give it an "intent" of what is to be bid. Contractor has not relied on any other dimensions than what are noted in text and dimension lines.

- 7.12.3 Contractor has thoroughly read the Contract Documents and has asked any and all questions it has on the intent of the scope of work, or supposed errors and omissions contained in these drawings, during the bid process and prior to signing this Agreement.
- 7.12.4 Contractor will not be asserting a claim for additional time or money associated with the three issues listed above.
- 7.12.5 Contractor believes it has accurately interpreted the Contract Documents and has asked for clarification and received satisfactory response for all items not thoroughly addressed or appeared to be conflicting in the Contract Documents and has found all stipulations and requirements contained in this Agreement are as stated in the bid specifications and are enforceable according to Ohio Law, including but not limited to the Owner's right of offset, and the Owner's right to assess liquidated damages for work not completed according to the milestones listed on the project schedule contained in the Contract Documents.

7.13 **ENTIRE AGREEMENT.** This Agreement and the other Contract Documents constitute the entire agreement among the parties with respect to their subject matter and will supersede all prior and contemporaneous, oral or written, agreements, negotiations, communications, representations, and understandings with respect to such subject matter, and no person is justified in relying on such agreements, negotiations, communications, representations, or understandings.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their properly authorized representatives and agree that this Agreement is effective as of the date first set forth above.

Owner: **Board of Trustees of Beavercreek Township**

Contractor: _____

By: _____

By: _____

Name: _____

Name: _____

Title: _____

Title: _____

Date: _____

Date: _____

CERTIFICATE

(Section 5705.41, R.C.)

The undersigned, fiscal officer of the Owner, certifies that the moneys required to pay that part of the Contract Sum coming due during the current fiscal year, under the Agreement to which this Certificate is attached have been lawfully appropriated for such purpose and are in the appropriate account of the Owner, or in the process of collection to the credit of the appropriate account or fund, free from any previous encumbrances. Moneys due in excess of the Contract Sum shall require an additional and separate Fiscal Officer's Certificate.

DATED: _____

Fiscal Officer

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

THIS DOCUMENT HAS BEEN MODIFIED FROM ITS ORIGINAL FORM.

for the following PROJECT:

(Name and location or address)

Beavercreek Township Fire Station No. 65
1777 Trebein Road
Beavercreek Township, Ohio 45385

THE OWNER:

(Name, legal status and address)

Beavercreek Township Board of Trustees
851 Orchard Lane
Beavercreek, Ohio 45434

THE ARCHITECT:

(Name, legal status and address)

App Architecture
615 Woodside Drive
Englewood, Ohio 45322

The Architect may also be referred to as the “Design Professional” in this Agreement and other Contract Documents.

This document has important legal consequences.

Consultation with an attorney is encouraged with respect to its completion or modification.

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

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS

Init.

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User Notes:

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12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES



Init.

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INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,
10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,
3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and
Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2,
4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4,
9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4
 Certificates of Inspection, Testing or Approval
 13.4.4
 Certificates of Insurance
 9.10.2
Change Orders
 1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2
Change Orders, Definition of
7.2.1
CHANGES IN THE WORK
 2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5
Claims, Definition of
15.1.1
 Claims, Notice of
 1.6.2, 15.1.3
CLAIMS AND DISPUTES
 3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
 Claims and Timely Assertion of Claims
 15.4.1
Claims for Additional Cost
 3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**
Claims for Additional Time
 3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**
Concealed or Unknown Conditions, Claims for
3.7.4
 Claims for Damages
 3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7
 Claims Subject to Arbitration
 15.4.1
Cleaning Up
3.15, 6.3
 Commencement of the Work, Conditions Relating to
 2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**
Commencement of the Work, Definition of
8.1.2
Communications
 3.9.1, **4.2.4**
 Completion, Conditions Relating to
 3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2
COMPLETION, PAYMENTS AND
9
 Completion, Substantial
 3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
 Compliance with Laws
 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3
 Concealed or Unknown Conditions
 3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract
 1.1.1, 6.1.1, 6.1.4
 Consent, Written
 3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2
Consolidation or Joinder
15.4.4
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
 1.1.4, **6**
Construction Change Directive, Definition of
7.3.1
Construction Change Directives
 1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1
 Construction Schedules, Contractor's
 3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Contingent Assignment of Subcontracts
5.4, 14.2.2.2
Continuing Contract Performance
15.1.4
Contract, Definition of
1.1.2
CONTRACT, TERMINATION OR SUSPENSION OF THE
 5.4.1.1, 5.4.2, 11.5, **14**
 Contract Administration
 3.1.3, 4, 9.4, 9.5
 Contract Award and Execution, Conditions Relating to
 3.7.1, 3.10, 5.2, 6.1
 Contract Documents, Copies Furnished and Use of
 1.5.2, 2.3.6, 5.3
Contract Documents, Definition of
1.1.1
Contract Sum
 2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**
Contract Sum, Definition of
9.1
 Contract Time
 1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5
Contract Time, Definition of
 8.1.1
CONTRACTOR
3
Contractor, Definition of
3.1, **6.1.2**
Contractor's Construction and Submittal Schedules
3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2
 Contractor's Employees

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors and Owner's Forces

3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors

1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1

Contractor's Representations

3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the Work

3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents

3.2

Contractor's Right to Stop the Work

2.2.2, 9.7

Contractor's Right to Terminate the Contract

14.1

Contractor's Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3

Contractor's Superintendent

3.9, 10.2.6

Contractor's Supervision and Construction

Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4

Coordination and Correlation

1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications

1.5, 2.3.6, 3.11

Copyrights

1.5, **3.17**

Correction of Work

2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents

1.2

Cost, Definition of

7.3.4

Costs

2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching

3.14, 6.2.5

Damage to Construction of Owner or Separate Contractors

3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damage to the Work

3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damages, Claims for

3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7

Damages for Delay

6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of

8.1.2

Date of Substantial Completion, Definition of

8.1.3

Day, Definition of

8.1.4

Decisions of the Architect

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification

9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of

2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

Definitions

1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time

3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission

1.7

Disputes

6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site

3.11

Drawings, Definition of

1.1.5

Drawings and Specifications, Use and Ownership of

3.11

Effective Date of Insurance

8.2.2

Emergencies

10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work

1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work

(See Defective or Nonconforming Work)

Final Completion and Final Payment

4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's

2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, 10.3

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,

9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,

14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,

11

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of

8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,

10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,

9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,

15.4

Liens

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,

4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,

11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,

5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,

15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, 10.3

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,

10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and

Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,

15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections
13.4.1, 13.4.2

Observations, Contractor's
3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

Owner's Right to Perform Construction and to

Award Separate Contracts

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

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

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Project, Definition of

1.1.4

Project Representatives
4.2.10

Property Insurance
10.2.5, 11.2

Proposal Requirements
1.1.1

PROTECTION OF PERSONS AND PROPERTY **10**

Regulations and Laws
1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,
10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8,
15.4

Rejection of Work
4.2.6, 12.2.1

Releases and Waivers of Liens
9.3.1, 9.10.2

Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

**Review of Contract Documents and Field
Conditions by Contractor**
3.2, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and
Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and
Samples by Contractor
3.12

Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,
6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,
12.2.4, 13.3, 14, 15.4

Royalties, Patents and Copyrights
3.17

Rules and Notices for Arbitration
15.4.1

Safety of Persons and Property
10.2, 10.4

Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, 10.1, 10.2, 10.4

Samples, Definition of
3.12.3

Samples, Shop Drawings, Product Data and
3.11, 3.12, 4.2.7

Samples at the Site, Documents and
3.11

Schedule of Values
9.2, 9.3.1

Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

Separate Contractors, Definition of
6.1.1

Shop Drawings, Definition of
3.12.1

Shop Drawings, Product Data and Samples
3.11, 3.12, 4.2.7

Site, Use of
3.13, 6.1.1, 6.2.1

Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4

Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Special Inspections and Testing
4.2.6, 12.2.1, 13.4

Specifications, Definition of
1.1.6

Specifications
1.1.1, 1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14

Statute of Limitations
15.1.2, 15.4.1.1

Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1

Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of
5.1.1

SUBCONTRACTORS **5**

Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4,
9.3.1.2, 9.6.7

Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1

Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3,
9.8, 9.9.1, 9.10.2, 9.10.3

Submittal Schedule
3.10.2, 3.12.5, 4.2.7

Subrogation, Waivers of
6.1.1, 11.3

Substances, Hazardous
10.3

Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3,
12.2, 15.1.2

Substantial Completion, Definition of
9.8.1

Substitution of Subcontractors
5.2.3, 5.2.4

Substitution of Architect
2.3.3

Substitutions of Materials
3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of
5.1.2

Subsurface Conditions
3.7.4

Successors and Assigns

13.2

Superintendent

3.9, 10.2.6

Supervision and Construction Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4,

7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers

1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6,

9.10.5, 14.2.1

Surety

5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2,

15.2.7

Surety, Consent of

9.8.5, 9.10.2, 9.10.3

Surveys

1.1.7, 2.3.4

Suspension by the Owner for Convenience

14.3

Suspension of the Work

3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract

5.4.1.1, 14

Taxes

3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor

14.1, 15.1.7

Termination by the Owner for Cause

5.4.1.1, 14.2, 15.1.7

Termination by the Owner for Convenience

14.4

Termination of the Architect

2.3.3

Termination of the Contractor Employment

14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT

14

Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4

TIME

8

Time, Delays and Extensions of

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7,

10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2,
5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,
9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14,
15.1.2, 15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK

12

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, 15.1.7

Waiver of Claims by the Owner

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, 11.3

Warranty

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2,
15.1.2

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3,
13.2, 13.3.2, 15.4.4.2

Written Interpretations

4.2.11, 4.2.12

Written Orders

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions The definitions in this Section 1.1 shall apply throughout the Contract Documents.

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, paperwork, reports, documentation, other requirements, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. The Work of the Contractor shall include the Work to facilitate the Work of all of its Subcontractors.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the Architect unless another person is identified in writing.

§ 1.1.9 [Not Used.]

§ 1.1.10 [Not Used.]

§ 1.1.11 [Not Used.]

§ 1.1.12 Substantial Completion

in the Agreement to render initial decisions on Claims Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy and utilize the Work for its intended use. Notwithstanding anything in the Contract Documents to the contrary, this shall include, but is not limited to, start up and successful testing of all systems and equipment.

§ 1.1.13 Date for Substantial Completion

The Date for Substantial Completion is the Date for Substantial Completion as set forth in the Owner-Contractor Agreement. The Date for Substantial Completion shall only be changed or modified by Change Order, other Modification, or a Claim that is Finally Resolved, regardless of any dates in the Construction Schedule.

§ 1.1.14 Final Completion

in accordance with Section 15.2. Final Completion shall mean that the Work is complete in all respects in accordance with the Contract Documents and the Contractor has submitted to the Architect all documents required to be submitted to the Architect for final payment.

§ 1.1.15 Date for Final Completion

The Date for Final Completion is the Date for Final Completion as set forth in the Owner-Contractor Agreement. The Date for Final Completion shall only be changed or modified by Change Order, or other Modification, or a Claim that is Finally Resolved, regardless of any dates in the Construction Schedule.

§ 1.1.16 Finally Resolved

Finally Resolved means that the Initial Decision Maker has made a decision on a Claim under Section 15.2.6.1 of the General Conditions and that any litigation regarding the Claim has been concluded.

§ 1.1.17 Claim

Claim is defined in Section 15.1.1 of these General Conditions.

§ 1.1.18 Statement of Claim Form

Statement of Claim Form means the Statement of Claim Form included with the Project Manual.

§ 1.1.19 Separate Contractor

Separate Contractor is defined in Section 6.1.1 of these General Conditions.

§ 1.1.20 Standard of Care

shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith. The Contractor shall perform its services consistent with the professional skill and care ordinarily provided by experienced contractors and working in the same or similar locality under the same or similar circumstances. Contractor shall perform its services as expeditiously as is consistent with such professional skill and care and the orderly progress of the Project.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. Contractor whether or not expressly shown or described. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; all and performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

§ 1.2.1.2 In the event of inconsistencies within or between the Contract Documents, the Contractor must provide the better quality or greater quantity of Work and must comply with the stricter requirements.

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

~~The parties shall agree upon protocols governing the transmission and use of~~ If the parties intend to transmit Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™ 2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data form, they shall endeavor to establish necessary protocols governing such transmissions, unless already provided in the Agreement or the Contract Documents.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set

forth in AIA Document E203™-2013, E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, G202™-2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 1.9 Preconstruction Conference

Before any Work at the Site is started, a conference attended by the Owner, Contractor, Architect, and others as appropriate may be held to establish a working understanding among the parties as to the Work and to discuss the Submittal Schedule, Construction Schedule, and Schedule of Values, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

§ 1.10 Initial Acceptance of Schedules

At least 10 days before submission of the first Application for Payment a conference attended by a Contractor, Architect, and others as appropriate will be held to review for acceptability to the Architect the schedules submitted in accordance with the Contract Documents, including a Submittal Schedule, Construction Schedule, and Schedule of Values. The Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to the Contractor until acceptable schedules are submitted to the Architect and Owner.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative may designate in writing a representative. The Owner's representative shall only have such authority as is expressly authorized by the Owner's legislative body and as is permitted under the law of the State of Ohio. The Contractor is responsible for determining the limits of that authority.

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

~~Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~[Not Used.]

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

§ 2.3.4 ~~The Owner shall~~ To the extent necessary for the Work and as requested by the Contractor, the Owner may furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work. The Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings listed below, and except for such reliance on "technical data," the Contractor shall not rely upon or make any claim against the Owner or Architect with respect to: (1) the completeness of such reports and drawings for the Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the Contractor, and safety precautions and programs incident thereto; or (2) other data, interpretation, opinions, and information contained in such reports or shown or indicated in such drawings; or (3) any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by the Contractor to estimate locations or quantities of subsurface strata are independent factual assumptions which the Owner does not warrant.

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

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

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or ~~repeatedly~~ fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such

order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ~~ten-day period~~ two (2) business days after receipt of notice from the Owner to commence and ~~continue~~ correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's or thereafter proceed without interruption to correct such default or neglect within fifteen (15) days of such notice, the Owner, without prejudice to its other remedies, may correct such deficiencies. If such default or neglect results in a threat to the safety of any person or property, the Contractor shall immediately commence to correct such default or neglect upon receipt of written or oral notice thereof. In all such cases of default or neglect, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the costs arising out of or related to the investigation and correction of such deficiencies, including Owner's attorneys' and consultants' fees and expenses and other expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents and shall comply with all rules, regulations, and policies of the Owner and all applicable federal, State, and local codes, statutes, ordinances, and regulations in the performance of the Work on the Project.

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the ~~Contract Agreement~~ by the Contractor is a representation that the Contractor has visited the site, ~~become generally~~ carefully and diligently investigated the entire site and surrounding area, including location, condition, and layout of the site and utility locations, ~~become thoroughly~~ familiar with local conditions under which the Work is to be performed, including the generally occurring climatic conditions and carefully correlated personal observations and other information with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, ~~Work and in addition to the reviews required by the Instructions to Bidders and by these General Conditions,~~ carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, 2.3.4. In addition, prior to performing each portion of its Work, the Contractor shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the it, including the Work of the other Contractors. The obligations of this Section 3.2.2 are for the purposes of facilitating construction by the Contractor, for determining that the Work is constructible, for determining if the work of the Contractor is coordinated in the Contract Documents with the Work of any other Contractors, and for verifying that field conditions, including the

Work any of other Contractors, are consistent with the information in the Contract Documents and ready for the Work. The Contractor shall promptly report to the Architect any errors, inconsistencies or omissions and the Owner any inconsistencies, errors, or omissions in the sizing, load bearing capacity, or other design information in the Contract Documents discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 ~~The Contractor is not required to ascertain that the Contract Documents are in accordance. Additionally, prior to performing each portion of the Work, the Contractor shall have a competent person review the Contract Documents for compliance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect and to the extent that Contractor discovers any conflicts, the Contractor shall immediately report to the Architect and Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.~~

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

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 ~~The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention.~~ attention and consistent with the skill of a competent contractor. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract-Contract Documents. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect, and shall not proceed with that portion of the Work without further written instructions from the Architect. The Contractor shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures. -The Contractor shall immediately upon entering the Project for the purpose of beginning work, locate all general reference points and take such action as necessary to prevent their destruction. The Contractor shall lay out his own work and be responsible for all lines, elevations, and measurements of the building, demolition work, utilities, and any other work to be executed by him under the contract. The Contractor shall verify grades, lines, levels, and dimensions indicated on the drawings and shall notify the Architect of errors or inconsistencies before commencing work. The Contractor shall establish and maintain a permanent benchmark, batter boards, level, and grades and shall lay out the exact location of all walls, partitions, openings, etc. The Contractor shall employ experienced and competent engineers and exercise proper precautions to verify the figures shown on the drawings for laying out work, and will be held responsible for any error resulting from his failure to exercise such precautions.

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

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

§ 3.3.4 The Contractor shall maintain readily accessible to the Architect and Owner at the Project site, the following documents all of which shall be “public records” within the meaning of the Ohio Public Records Act:

- .1 A set of Drawings and Specifications, as approved by the appropriate authority having jurisdiction.
- .2 Unless otherwise specifically provided in the Contract Documents, a neat and legible set of As-Built Drawings and Project Manuals on which:
 - .1 The Contractor shall keep an accurate record of all approved changes made to the Drawings to show actual installation where installation varies from Work as originally shown, including the exact location and depth of underground utility lines. Any such changes shall be noted by Change Order Number and drawn neatly in a contrasting color;
 - .2 The Contractor shall also keep record of all changes to the Specifications. When Shop Drawings are used, the Contractor shall cross-reference the corresponding sheet numbers on the As-Built Drawings and sections of the Specification;
 - .3 A daily log at the Project site in which it has recorded Project-related information, including, but not limited to, the weather, number of workers on site for each Contractor, identification of equipment, Work accomplished, problems encountered, and other similar relevant Project data;
 - .4 As applicable to its Work, all Bulletins, Addenda, approved Shop Drawings, Product Data, Samples, manufacturers’ installation, operating and/or maintenance instructions or requirements, certificates, warranties, Change Orders, Change Directives, other Modifications, and complete back-up data for all Change Orders, Change Directives, and other Modifications;
 - .5 All the Contractor’s communications, including but not limited to letters, memoranda, e-mail, invoices, and bills of lading, arising out of or related to the Project with the Architect, Owner, and/or its subcontractors, materialmen, and/or employees; and
 - .6 The payroll reports for its employees and the employees of its Subcontractors working on the Project.
- .3 Claims for the Contractor’s failure to comply with the Ohio Public Records Act, if applicable, shall be claims under Section 3.18.1.
- .4 Any other forms required under the terms of the Agreement.

§ 3.4 Labor and Materials

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

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

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor’s employees and other persons carrying out the Work. The Contractor shall ~~not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.~~ only assign competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks assigned. If the Owner or Architect deems any employee of the Contractor or a Subcontractor unsatisfactory, the Contractor will transfer or require its Subcontractor to transfer such employee from the Project immediately and replace or require the prompt replacement of such employee with a competent employee. The Owner, however, shall be under no obligation to do so.

§ 3.5 Warranty

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

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4. If the Contractor breaches any of its obligations under Section 3.5.1, the Contractor will pay the Owner for its damages and expenses, including but not limited to attorneys' and consultants' fees and expenses, arising out of or related to such breach.

§ 3.5.3 Except to the extent that the Contractor has notified the Architect in writing at least ten (10) days prior to the bid opening of specific problems with specified equipment or materials, the Contractor warrants that any equipment or materials selected by it from among the equipment or materials specified will be fit for its intended purposes, compatible with the design intent, and, if the other contractors construct their work in accordance with the Contract Documents, constructible all without additional cost to the Owner. Such notice shall be conspicuously labeled at the top of the first page in not less than twelve point type as follows: "NOTICE OF PROBLEMS WITH SPECIFIED EQUIPMENT OR MATERIALS."

§ 3.6 Taxes

The Contractor shall pay sales, consumer, ~~use-use, commercial activity,~~ and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor acknowledges that the Owner is a political subdivision of the State of Ohio or tax exempt organization and is exempt from state sales, and use taxes. Upon written request, the Owner will provide the Contractor with any applicable certificates of exemption.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

§ 3.7.3 ~~If the Contractor~~ In addition to its other obligations under the Contract Documents, if the Contractor or any of its Subcontractors or Sub-subcontractors performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders and all other requirements of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

~~If Subject to Section 2.3.4 of these General Conditions, and except as provided herein, if the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or~~

both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and ~~Contractor~~, Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.7.6 Prevailing Wage Rates

Each laborer, worker, or mechanic employed by the Contractor, Subcontractor, or other persons performing Work on the Project shall be paid not less than the applicable prevailing wage rates pursuant to Ohio Revised Code Chapter 4115.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent & Construction Supervision

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

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

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not ~~change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.~~ replace the assigned Superintendent without the Owner's consent, except with another Superintendent who is satisfactory to the Owner. If the Contractor proposes to change the Superintendent, the Contractor must submit to the Architect a written request for the change, including the justification for the change, the name and qualifications for the proposed replacement, and the time frame within

which the change is proposed to take place. The Contractor shall provide promptly any related additional information the Architect or Owner requests.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of within five (5) days of the date of any request from the Architect or the Owner to submit scheduling information, shall submit the scheduling information for its Work to the Architect and to the Owner in such form and in such detail as requested. The Contractor shall prepare the Construction Schedule within ten (10) days after the date of the Effective Date. The Construction Schedule shall include and be consistent with any applicable Milestone Dates in the Bidding Documents or otherwise provided by the Owner. The Contractor shall prepare all Construction Schedules in CPM format unless provided otherwise in the Contract Documents or otherwise agreed in writing by the Owner. Each major category of work shall be shown separately in the Construction Schedule with all the significant activities involved, showing durations of time, manpower requirements, and restraints. The Construction Schedule is for the purpose of coordinating the timing, phasing, and sequence of the Work of the Contractor and shall not change or modify the Date for Substantial Completion. The Date for Substantial Completion shall only be changed or modified by Change Order, other Modification, or a Claim that is Finally Resolved, regardless of the dates in the Construction Schedule.

~~each portion.~~ **1** The Contractor shall update the Construction Schedule each month;

~~of the Work.~~ **2** The Construction Schedule shall be manpower loaded and shall include a schedule of the submission of Shop Drawings, Product Data, and Samples;

~~The schedule shall provide for the orderly progression of the Work.~~ **3** The Contractor shall, on a weekly basis, prepare and submit to the Architect and Owner a written report describing the activities begun or finished during the preceding week, Work in progress, expected completion of the Work, a look-ahead projection of all activities to be started or finished in the upcoming two (2) weeks, including without limitation the Contractor's workforce crew size and total resource hours associated with such Work and any other information requested;

~~to completion and shall not exceed time limits current under the Contract Documents.~~ **4** The float in the Construction Schedule and any updates to it shall belong to the Owner. Float shall mean the amount of time by which activities may be delayed without affected the Contract Date for Substantial Completion; and

~~The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.~~

5 The Contractor's obligation to submit requested scheduling information is a material term of its Contract. If the Contractor fails to submit requested scheduling information in writing within five (5) days of a request for such information from the Architect or Owner, the Contractor shall pay and the Owner may withhold from the Contractor Liquidated Damages at the rate of Fifty Dollars (\$50.00) a day for each calendar day thereafter that the Contractor fails to submit the requested information.

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

§ 3.10.3 The Contractor shall perform the Work in ~~general~~ accordance with the most recent schedules submitted to the Owner and Architect. Construction Schedule submitted to the Owner and Architect, provided that the Contractor shall comply with any orders under Section 3.10.4. However, preparation of such schedule shall not constitute a

waiver of the Owner's rights under the Contract to have the Work completed by the contractual dates of Substantial and Final Completion.

- .1 Notice of Delays.** The Contractor shall give the Owner and the Architect verbal notice of any delay affecting the Work within two (2) business days of the commencement of the delay. In addition, the Contractor shall give the Owner and Architect written notice of the delay within ten (10) business days of the commencement of the delay with specific recommendations about how to minimize the effect of the delay. The written notice of the delay shall conspicuously state at the top of the first page of the notice in twelve point type or larger that it is a **"NOTICE OF DELAY."** A notice of delay shall not constitute the submission of a Claim. The Contractor acknowledges and agrees that these notice provisions are material terms of the Contract Documents and give the Owner the opportunity to take action to minimize the cost and/or effect of delays.

§ 3.10.4 If the Architect or the Owner determines that the performance of the Work has not progressed so that it is likely that the Contractor will not Substantially Complete its Work by its Date of Substantial Completion, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the Work, including, without limitation: (i) working additional shifts or overtime; (ii) supplying additional manpower, equipment, and facilities; and (iii) other similar measures (collectively referred to as "Corrective Measures"). If the Owner order the Contractor to take such corrective measures, the Contractor shall take and continue such Corrective Measures until the Owner is satisfied that the Contractor is likely to Substantially Complete its Work by its Date for Substantial Completion.

- .1** The Contractor shall not be entitled to adjustment in the Contract Sum in connection with the Corrective Measures required by the Owner pursuant to this Section 3.10.4, unless the Contractor is able to establish that it is entitled to additional compensation under the terms of the Contract Documents.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals, maintain at the Project site for the Owner and the Architect the documents required by Section 3.3.4. These shall be in electronic form or paper copy, available to the Architect and Owner, and shall be delivered to the Architect in the form requested by the Owner for submittal to the Owner upon completion of the Work as a record of the Work as constructed or earlier when required by the Contract Documents.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work. Shop Drawings shall also include fabrication, erection and setting Drawings, scheduled Drawings, manufacturer's scale Drawings, wiring and control diagrams, cuts or entire catalogs, pamphlets, descriptive literature, performance, and technical data.

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

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

- 1 If the Shop Drawings or other submittals show variations from the requirements of the Contract Documents, the Contractor shall specify such variations in the Contractor's letter of submittal to the Architect accompanying the submittal. Variations must be approved by Change Order.
- 2 If the Contractor's Shop Drawings or its submittals do not contain sufficient information, and the Architect must perform more than two reviews with respect to any submittal, the Contractor shall pay the additional costs and expenses incurred by the Owner as a result of such additional reviews by the Architect, and the Owner may withhold from sums due or coming due the Contractor amounts to cover such additional costs and expenses.

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a ~~design professional architect~~ related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. ~~The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents.~~ The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, a properly licensed architect who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy-adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy- architects.

Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.10.2 If [Not Used.]

§ 3.12.11 Instructions. Unless otherwise expressly provided in the Contract Documents, the Contractor shall provide typed or printed instructions covering the operation and maintenance of each item of equipment furnished in a notebook submitted to the Architect for review and transmittal to the Owner. The instructions, as applicable, shall include the following:

- .1 Any schematic piping and wiring diagrams;
- .2 Any valve charts and schedules;
- .3 Any lubrication charts and schedules;
- .4 Guides for troubleshooting;
- .5 Pertinent diagrams and maintenance instructions for all equipment;
- .6 Manufacturer's parts list;
- .7 Operating and maintenance instructions for all equipment;
- .8 Manufacturer's data on all equipment;
- .9 Any testing procedures for operating tests; and
- the Contract Documents require-.10 Other instructions and materials as required by the Contract Documents.

The Contractor shall provide two (2) copies of the above instruction books on or before the Substantial Completion of its Work. The books shall describe the information to be covered clearly and in detail and shall be in form and content satisfactory to the Architect and the Owner.

the Contractor's design professional to certify that the **§ 3.12.12 Testing Following Final Completion.** The Contractor will participate in training sessions for the Owner's maintenance personnel. During the first twelve (12) months following Final Completion of each part of the Project, the Contractor (without additional compensation) will participate in tests scheduled by the Owner, which test the following building systems to the extent applicable to the Contractor's Work; air conditioning system (which shall be conducted during the first full summer following the completion of the Project or at such earlier time as scheduled by the Owner), heating system (which shall be conducted during the first full winter following the completion of the Project or at such earlier time as scheduled by the Owner), and such other systems, including the electrical system, plumbing system, fire protection system, and communications systems, as reasonably requested by the Owner. The Owner will be advised when the testing will be conducted and may observe the testing. It is intended that the testing be a comprehensive series of operation tests designed to determine whether the systems are fully operational in accordance with the requirements of the Contract Documents. If it appears that any of the systems, including equipment and software, do not conform to the requirements of the Contract Documents, the Contractor will remedy the defective and/or non-conforming work as provided in Section 12.2.2.1 of these General Conditions.

Work has been performed in accordance with the design criteria, the **§ 3.12.13 Manufacturer's Instructions or Requirements.** Without waiving, modifying, or relieving the Contractor from its other obligations under the Contract Documents, including its warranties and any performance specifications, the Contractor shall furnish and install its Work in accordance with any applicable manufacturer's instructions and requirements. Prior to installation, the Contractor shall review carefully the manufacturer's instructions or requirements, and if there is a conflict between such instructions or requirements and the Drawings and/or Specifications, the Contractor shall request clarification from the Architect prior to commencing the Work.

§ 3.12.14 The Contractor shall furnish such certifications for each submission of Shop Drawings, one (1) transparency reproduction and sufficient number of prints so the Architect can retain four (4) copies. Where the nature of the material being submitted is such that letter size sheets are a convenient method of presentation, such sheets shall be assembled in the form of booklets with covers showing the name of the job, the names of the Contractor and subcontractor or vendor, the location on the job and a list of the sheets contained. Such booklets need

not be in the form of transparencies. Do not submit complete catalogues with items checked for use as shop drawings.

§ 3.12.15 After review of the submittal, the Architect will return the transparency to the Contractor marked “approved” or “not approved” and shall furnish promptly one copy in either case to the Owner for information and reference purposes on the job. If marked “not approved,” the Contractor shall resubmit showing corrections made. After the transparency has been stamped “approved,” the Contractor shall distribute all necessary prints to trades involved. No Shop Drawings shall be used if not stamped “approved” by the Architect. All work shall be done in accordance with approved Shop Drawings.

§ 3.12.16 Schedules, diagrams, cuts, catalogues, data, etc., as mentioned in this Section 3.12, shall be furnished in sufficient numbers so the Architect can retain four (4) copies and the Contractor will have the necessary number for its distribution. One copy of each of these shall be furnished the Owner by the Architect for reference on the job and for his permanent records.

§ 3.12.17 All Contractors furnishing material or equipment where shop or setting drawings are required shall obtain measurements and observe conditions at the job and indicate on their drawings that such dimensions have been field measured. The Contractor shall affix its stamp of approval on the drawings as evidence they have been checked before submitting them to the Architect for approval. Where information from one Contractor is required by another before drawings can be made, that information shall be given in sufficient time to cause no delay on the part of either party.

§ 3.12.18 The Contractor shall maintain a separate complete clean set of all shop drawings, data, and correspondence pertinent to maintenance requirement. This complete file shall be submitted to the Owner upon Substantial Completion. Drawings shall contain all changes made during construction.

§ 3.12.19 The Contractor shall keep a complete record of all drawings including dates of issuance, receipt, and approval. A second set shall be maintained at the Project job site.

~~in the form specified by the Architect.~~ **§ 3.12.20** When the Contractor requests a change in any item which will involve a change in related items or supports, the Contractor requesting the change shall be responsible for, and pay all costs in connection with such changes. Changes shall be recorded on shop drawings.

§ 3.13 Use of Site

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

§ 3.13.1.1 Damage to road, features, or the grounds, resulting from hauling, storage of materials, or other activities connected with the Work, will be repaired by the Contractor at its expense to the satisfaction of the Architect.

§ 3.13.2 Signage. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

§ 3.13.3 Restricted Activities. Unless expressly permitted by the Contract Documents or by the Owner in writing, the Contractor shall not interfere with the Owner’s ongoing operations, shall not permit any of its employees or its Subcontractor’s or materialmen’s employees to use any existing facilities on the Project site, including, without limitation, lavatories, toilets, entrances, and parking areas, and shall not permit its employees or its Subcontractor’s or materialmen’s employees to bring any tobacco products, alcoholic beverages, controlled substances, or firearms onto the Project site or any other property owned or controlled by the Owner. Additionally, the Contractor shall not permit its employees or its Subcontractor’s or materialmen’s employees to use any radios, tape, or compact disc players, or sound amplification equipment at or near the Project site.

§ 3.13.4 The Contractor shall conspicuously post notice of the prohibitions listed in the preceding subparagraphs at the Project site in the same locations as OSHA notices are required to be posted, and shall verbally inform all of the

Contractor's employees and the employees of the Contractor's Subcontractors and materialmen, regardless of tier, of such

§ prohibitions.

§ 3.14 Cutting and Patching

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

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

§ 3.14.3 Patching resulting from operations of any Contractor shall be performed by workers skilled in the trade being patched, and paid for by the Contractor causing such patching.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project. At weekly intervals and as directed by the Owner, the Contractor shall clean up the job. The Contractor shall remove all discarded materials, rubbish, and debris from the premises, taking care to avoid scattering debris along the path of travel. The Contractor shall have a dumpster on the site so as to maintain clean and safe conditions throughout the duration of the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor. The Architect's determination of the costs to be charged to the Contractor shall be final and binding.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located. The Contractor is responsible to provide proper facilities for such access and observation and to provide access to the Work in preparation and progress for special inspections required by the building department or authority having jurisdiction.

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall ~~indemnify~~ indemnify, defend, and hold harmless the Owner, Architect, Architect's consultants, and ~~agents~~ the officers, directors, partners, consultants, subcontractors, agents, and employees of any of them from and against ~~claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a~~

party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18. claims (whether alleged or proven), demands, costs, losses, and/or damages, including but not limited to all fees and charges of architects, engineers, attorneys, and other professionals and all court, arbitration, or other dispute resolution costs, arising out of or relating to any claim or action, legal or equitable, caused or alleged to have been caused by the Contractor's performance of the Work, including but not limited to the Contractor's negligent performance of the Work, or any breach of the Contractor's obligations under the Contract Documents, including but not limited to the breach of any warranty provided in the Contract Documents.

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

§ 3.19 Compliance with Demolition Laws

The Contractor will, at the Contractor's expense, fully comply with all statutes and regulations regarding notification and disposal of construction and demolition debris, including, without limitation, Ohio Revised Code Chapter 3714 and the regulations enacted thereunder.

§ 3.20 Underground Utility Facilities

§ 3.20.1 The Contractor, at least two (2) working days prior to commencing any construction in an area that may involve underground utility facilities, shall give notice to the Architect and the Owner and to the registered underground utility protection services and the owners of underground utility facilities shown on the Drawings and Specifications.

§ 3.20.2 The Contractor shall notify immediately the occupants of any premises near the Work and the Architect and the Owner as to any emergency that it may create or discover. The Contractor shall notify immediately the operator of any underground utilities and the Architect and Owner of any break or leak in the lines of such operator or any dent, gouge, groove, or other damage to such lines or to their rating or cathodic protection, made or discovered in the course of excavation.

§ 3.21 Waivers of Claims

§ 3.21.1 Beginning with the second Application for Payment, the Contractor will submit (a) a release and/or waiver of claims, including a waiver of all lien rights, in the form included in the Contract Documents or required by the Owner for itself and each of its Subcontractors and Suppliers, regardless of tier, and (b) a complete list of its Subcontractors and Suppliers in the form included in the Contract Documents or as required by the Owner.

§ 3.22 Records and Audits

The Contractor shall keep full and detailed accounts and exercise such controls as may be necessary for proper financial management under the Agreement; the accounting and control systems shall be satisfactory to the Owner. The Owner and the Owner's accountants shall be afforded access to review and audit the Contractor's records, books, correspondence, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda, timesheets, payroll, and other data relating to this Project, records of time spent by each person performing work on the Project, and time spent on all other projects; such time and payroll records shall include the location of services, detailed description of time and work on this Project and any other projects (redacting the client name or description to the extent necessary) and the Contractor shall preserve these for a period of four (4) years after final payment, or for such longer period as may be required by law. The Contractor shall make all such records, books, correspondence, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda, timesheets, payroll, and other data relating to this Project, available to the Owner and the Owner's accountants in a location designated by the Owner at the time of the Owner's request. In the event that the Contractor's records are not available at the agreed upon time or place, or in the event that the Owner finds incomplete records or inaccurate accounting of paid expenses, the Contractor shall reimburse the Owner for its time, travel, and related expenses, and the Contractor shall reimburse the Owner the full amount of any discrepancies or overages.

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

§ 4.2.1 ~~The Unless otherwise set forth in the Agreement, the Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction (1) during construction, (2) until the date the Architect issues the final Certificate for Payment, Payment, and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2 and for such additional periods as the Owner and Architect may agree. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents. Documents and as authorized by the Owner.~~

§ 4.2.2 The Architect will visit the site ~~at intervals appropriate to the stage of construction, or as otherwise agreed upon~~ with the Owner, (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work ~~observed~~ is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract ~~Documents. Documents, except as provided in Section 3.3.1.~~

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner ~~reasonably~~ informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. ~~The Architect will not be responsible. Except as required by its duty of care owed to the Owner, the Architect (a) will not be responsible to the Owner for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect Documents, and (b) will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.~~

§ 4.2.4 Communications - Facilitating Contract Administration

~~The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with Separate Contractors under contract directly with the Owner shall be through the Owner. The Contract Documents may specify other communication protocols.~~

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

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

Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions ~~or or, unless otherwise specifically stated by the Architect,~~ of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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

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

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. ~~The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives. such Project representatives shall be consistent with these General Conditions.~~

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. Copies of all Requests for Information shall be copied to the Owner by the Contractor at the time they are submitted to the Architect.

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

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them and the Contractor establishes the Architect's delay in responding delayed the critical path of the Work. In its requests for information, the Contractor shall clearly identify the number of business days for the Architect to review and respond without any potential impact to the critical path or potential delay.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term “Sub-subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and the Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within ~~14~~ fourteen (14) days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the ~~14-day~~ fourteen (14)-day period shall constitute notice of no reasonable objection. Copies of all bids or other proposals from Subcontractors or Sub-subcontractors shall, upon the request of the Owner or Architect, be submitted to the Owner and the Architect.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made ~~reasonable and~~ timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has ~~reasonable an~~ objection to a person or entity proposed by the Contractor, the Contractor shall propose within 10 days another to whom the Owner or Architect has no ~~reasonable~~ objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect ~~makes reasonable objection to such substitution~~ objects to such substitute. The Owner, through the Architect, may require the Contractor to change any Subcontractor previously approved and, except as provided hereafter, the Contract Sum shall be increased or decreased by the difference in cost resulting from such change. If the Contractor is in default because of the Subcontractor's performance, then the Contractor shall not be entitled to any adjustment in the Contract Sum and shall remain liable to the Owner for any damages or losses caused by such default.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will

similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and ~~Contractor~~; Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

~~When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.~~

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in ~~cost~~ direct costs incurred by the Subcontractor resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. ~~If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, ~~and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract and/or award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these, including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.~~

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

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

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall ~~have the same obligations and rights that the Contractor has~~ be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly ~~notify the Architect of report to the Architect~~ report to the Architect apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for such proper execution and results of the Contractor's Work. Failure of the Contractor to ~~notify the Architect of apparent discrepancies or defects prior to proceeding with the Work so report~~ report shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. ~~The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.~~ Work, except as to defects not then reasonably discoverable.

§ 6.2.3 ~~The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.~~ [Not Used.]

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate ~~Contractor~~ Contractor, if any, shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible. The Architect's decision allocating the cost shall be final and binding on the Contractor and the Owner.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. To be valid, all changes involving an increase in the Contract Sum must have any required funding certificates attached to them.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 All such Changes in the Work shall be submitted with any required backup documentation to the Owner and Architect in writing in advance of performance of the Work and must be approved by the Owner in writing prior to commencement of the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- 1 The change in the Work;
- 2 The amount of the adjustment, if any, in the Contract Sum; and
- 3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3. Notwithstanding the method used to determine the adjustment to the Contract Sum, the Contractor must provide documentation to support any cost included in the request. Documentation may include invoices and time records related to the costs, but must be in a form acceptable to the Architect and Owner.

Costs included in any Change Order request must be limited to those in Section 7.3.7, unless provided elsewhere in the Contract Documents or agreed to by the Owner and Architect.

§ 7.2.3 The agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including but not limited to, all direct, indirect, and cumulative costs associated with such change and any and all adjustments to the Contract Sum and Contract Time. The Contractor shall not proceed with any change in the Work without a signed Change Order, Construction Change Directive, or Minor Change in the Work notice. The Contractor's failure to timely seek and obtain such authorization as specified herein, shall constitute an irrevocable waiver by the Contractor of an adjustment to the Contract Sum or Contract Time for the related work.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3** ~~Cost-Subject to a not-to-exceed amount, a cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or~~
- .4** As provided in Section 7.3.4/7.3.7; or
- .5** Except where unit prices are applicable, that the Contractor agrees and represents to the Owner for the Owner's reliance that all Change Order or Change Directive pricing submitted by the Contractor shall be based on the Contractor's actual costs or the Contractor's reasonable estimate of what would be its actual costs plus permitted overhead and profit.

§ 7.3.4 [Not Used.]

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. present a true and accurate itemized accounting of all labor and material with appropriate supporting data. If the Architect prescribes a format for such accounting, the Contractor shall provide the accounting in such format. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4-7.3.7 shall be limited to the following:

- .1** Costs of labor, including social security, old age, and unemployment insurance, applicable payroll taxes, fringe benefits required by agreement or custom, and workers' compensation insurance, and other employee costs approved by the Architect. All field labor shall be priced at the

- current base rate of the prevailing wage in the Project locality. Contractor pricing information shall include the number of hours and rate of pay for each classification of worker;
2. Costs of materials, materials (including any and all discounts, rebates, or related credits, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
 3. Rental costs of machinery and equipment, exclusive of hand tools, minor equipment, simple scaffolds, etc. whether rented from the Contractor or others; others. Charges for certain non-owned heavy or specialized equipment may be invoiced at up to 100% of the documented rental cost. The Contractor shall submit copies of actual paid invoices to substantiate rental costs; Charges for certain Contractor-owned, heavy or specialized equipment may be invoiced at up to 100% of the cost listed by the current edition of the Associated Equipment Dealers Green Book rental rates and specifications for construction equipment. No recovery will be allowed for hand tools, minor equipment, simple scaffolds, etc. The longest period of time that the equipment is to be required for the Work shall be the basis for the pricing. Downtime due to repairs, maintenance and weather delays should not be allowed;
 4. Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and Work/change;
 5. Costs Additional reasonable costs of supervision and field office personnel directly attributable to the change; change; and

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15. **6 Total cumulative overhead and profit for all Subcontractors and Contractor**

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. **on any add or deduct Change Order shall not exceed 15% of the total cost of**

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order. **labor and material.**

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change order that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. Architect plus the credit for overhead and profit. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, or decrease if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The Contractor shall not assign any portion of the Work to another contractor whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead and profit.

§ 7.3.12 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.13 The Contractor shall not be reimbursed for the following costs:

- .1 Employee Profit Sharing Plans regardless of how defined or described, the Contractor will pay these charges from Contractor profit and will not be reimbursed
- .2 Voluntary Employee Deductions (e.g., United Way Contributions, U.S. Savings Bonds, etc.)

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in ~~writing~~, writing conspicuously marked at the top of the order as a "MINOR CHANGE IN THE WORK" and signed by the Architect and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 ~~The date of commencement~~ Date of Commencement of the Work is the date established in the Agreement.

§ 8.1.3 ~~The date~~ Date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, ~~commence the Work prematurely~~ commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The Date of Commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by ~~(1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay,~~ an Excusable Delay as set forth in Section 15.1.5.3, then subject to the agreement of the Owner, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

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

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted. [Not Used.]

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, Within 10 days of the Effective Date, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, for the Architect's review and approval, allocating the entire Contract Sum to the various portions of the Work. The schedule of values Schedule of Values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, By submitting such Schedule of Values, the Contractor represents for the reliance of the Architect and the Owner that the allocation of the values to the portions of the Work is a fair and reasonable estimate of such allocation. Once approved, the Contractor will not change the allocations in the Schedule of Values without the Architect's further approval. The Architect may from time to time require the Contractor to adjust such schedule if the Architect determines it to be in any way unreasonable or inaccurate. The Contractor then shall adjust the Schedule of Values as required by the Architect within ten (10) days. This schedule, with any adjustments approved by the Architect shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values Schedule of Values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment. The Contractor shall include a separate line item in its Schedule of Values for its Project Superintendent.

§ 9.2.1 The Contractor will identify in its Schedule of Values a line item entitled "As-Built Drawings and Record Documents." The Scheduled Value for this item will be one and one-half percent (1.5%) of the Contract Sum for contracts with a Contract Sum of \$1,000,000 or less, and one percent (1%) of the Contract Sum for contracts with a Contract Sum greater than \$1,000,000. When As-Built Drawings and Record Documents are received and reviewed by the Architect, and a letter is forwarded to the Owner affirming the completeness of these documents, these costs may be released. At the Owner's discretion, the costs dedicated to this Scheduled Value may be adjusted to reflect adjustments to the Contract Sum due to approved change orders. Unless specifically approved in writing by the Owner, retained funds will not be released until As-Built Drawings and Record Drawings are received, reviewed, and deemed complete by the Architect.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten-three days before the date established in Section 9.3.1.3 for each progress payment, the Contractor shall submit to the Architect an itemized Owner and Architect a draft Application for Payment prepared in accordance with the schedule of values, Schedule of Values, if required under Section 9.2, for completed portions of the Work. The application draft Application for Payment shall be reviewed and adjusted, if necessary, by the Architect and returned to the Contractor. The Application for Payment, as reviewed and adjusted by the Architect, shall be notarized, if required, and supported by all be re-submitted with all the documentation required to be submitted with such Application for Payment, and any other supporting documentation required by the Contract Documents or by the Architect. The percentage completion of each portion of the Work shall be consistent with the then current Construction Schedule for the Project. The Application for Payment will be in the form and submitted with the number of copies and all related documents as required by the Contract Documents. The Contractor also shall submit with its Application for Payment and such other documents and/or data substantiating the Contractor's right to payment that the Owner or Architect as Owner or Architect may require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents. The Contractor shall also provide its monthly report detailing the Project's progress to date, projected progress for the next thirty (30) days and current project financial summary, including but not limited to:

- .1 The balance of any construction allowances and summary list of how the allowances have been expended to date.
- .2 A change order log showing any proposed, pending, and approved change order expenses to date.

3 Complete breakout showing the total completed and/or stored materials, labor, and equipment on the Project as of the date of the payment application, and anticipated schedule of payment applications detailing projections for the value of completed and/or stored materials, labor, and equipment, month by month, through the end of the Project.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Contractor shall submit its Application for Payment to the Architect on AIA Documents G-702 and G-703 and Certification or such other format as the Owner specifies, on or before the twenty-fifth (25th) day of each month for Work completed to that date. The Owner will issue payment to the Contractor within thirty (30) days from the date of its receipt of the certified Application for Payment from the Architect and in compliance with all of the Owner's policies, procedures, and documentation requirements.

§ 9.3.1.4 The Contractor shall provide lien waivers from itself and all subcontractors, material suppliers, and any other party that performed work or supplied materials for the Project. Each Application for Payment shall include, in the form included in the bid package, lien waivers from each of the aforementioned parties for the work performed to date on the Project and for the value of the work performed during the current billing period. A final waiver of lien in the form included in the bid package, for the total value of each subcontract shall be included with the final Application for Payment for each subcontract and with the Contractor's final pay application for the Project. The total of the lien waivers shall match the total amount paid to the Contractor, inclusive of all approved change orders.

§ 9.3.1.5 Partial payments to the Contractor for labor performed shall be made at the rate of 92 percent of the amount invoiced through the Application for Payment that shows the total Contract Completion at 50 percent or greater, pursuant to Ohio Revised Code Section 153.14. After the Contract is 50 percent complete as evidenced by payments in the amount of at least 50 percent of the Contract Price to the Contractor, no additional funds shall be retained from payments for labor. The Owner will withhold retainage from the amount set forth in the Application for Payment approved by the Architect, as provided in the Contract Documents.

§ 9.3.1.6 Documentation. Upon request, the Contractor immediately will supply the Owner and the Architect with such information as may be requested as to verify the amounts due to the Contractor, including but not limited to original invoices for materials and equipment and documents showing that the Contractor has paid for such materials and equipment, and so as to verify that amounts due laborers, Subcontractors, and Material Suppliers have been paid to them. The failure to provide such information shall be justification for withholding payment to the Contractor.

§ 9.3.1.7 Retainage or Other Escrow Account. Owner and Contractor acknowledge that R.C. 153.63 provides that retained and detained funds will be deposited in an escrow account governed by an escrow agreement with a third party escrow agent. If Contractor wishes to have funds so deposited, (1) Contractor must provide written notice to the Owner of the request for an escrow account prior to submission of the first pay application, (2) Contractor will be responsible for all expenses associated with the escrow agent and escrow account beyond the interest income from the account, which will be paid for out of the principal amount deposited into the escrow account, and (3) Contractor must enter into a mutually agreeable written escrow agreement with the Owner and the escrow agent. If the Contractor does not request an escrow account prior to the submission of the first pay application or, in the event Contractor does timely request an escrow account before submission of the first pay application, if Contractor cannot (or does not) agree to a mutually agreeable escrow agreement, the Contractor consents to the following: (a) Owner may deposit funds into a savings or checking account established by the Owner (which may also contain other funds); (b) Owner will not be serving in a fiduciary capacity while holding the funds; (c) Owner is not required to deposit the funds into a separate escrow account governed by an escrow agent; and (d) the foregoing satisfies the Owner's obligations under R.C. 153.63 as it pertains to both R.C. 153.12 (retained funds) and 1311.28 (detained funds).

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

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities ~~that making a claim by reason of having~~ provided labor, materials, and equipment relating to the Work. The Contractor agrees to bond off any lien filed on the real property on which the Project is located, the Owner's interest in such real property, and/or the remaining balance of the Contract Sum by providing a bond meeting the requirements of the Ohio Revised Code. The Contractor shall do so within sixty (60) days of the filing of the lien.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's ~~Application for Payment, either (1) properly completed Application for Payment and Contractor's Payment Application Checklist (if required) and Certification, the documentation described in the Contractor's Payment Application Checklist and Certification, and such other documents and/or data substantiating the Contractor's right to payment as the Owner or Architect may require, either issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment Contractor, for such amount as the Architect determines is properly due, and or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole whole or in part as provided in Section 9.5.1.~~

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data ~~in comprising~~ the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, and that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to

such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- ~~.1 defective Work not remedied;~~remedied or the Contractor is in default of the performance of any of its obligations under the Contract Documents including but not limited to: failure to provide sufficient skilled workers, failure to provide scheduling information as provided in Section 3.10.1, failure to prepare the Construction Schedule as provided in Section 3.10.1, failure to conform to the Construction Schedule, and/or failure to coordinate its Work with the work of other contractors, if any;
- ~~.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;~~
- ~~.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;~~
- ~~.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;~~
- ~~.5 damage to the Owner or a Separate Contractor;~~
- ~~.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or~~
- ~~.7 repeated failure to carry out the Work in accordance with the Contract Documents.~~Documents;
- .8 the Contractor is in default of the performance of any of its obligations under another contract it has with the Owner.**

§ 9.5.2 ~~When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.~~[Not Used.]

§ 9.5.3 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier-material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the ~~Contractor~~Architect shall reflect such payment on its ~~next Application~~the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall ~~make payment in the manner and within the time provided in the Contract Documents,~~issue payment to the Contractor as set forth herein and shall so notify the Architect.

§ 9.6.2 The Contractor shall ~~pay each Subcontractor, no later than seven days after promptly, within the time period required by Ohio law, pay each Subcontractor upon receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner. Neither the Contractor nor its Subcontractors shall withhold retainage from its Subcontractors or their sub-subcontractors beyond the retainage withheld by the Owner from the Contractor.~~

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, Owner does not pay the Contractor the amount certified by the Architect within thirty (30) days after receipt of the certified Application for Payment for the Architect and the Owner has no other basis to withhold payment pursuant to the Contract Documents, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is ~~the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use defined in Paragraph 1.1.12 herein.~~ Notwithstanding anything in the Contract Documents to the contrary, this shall include, but is not limited to, start up and successful testing of all systems and equipment.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final ~~payment.~~ payment together with all required documents neatly bound and indexed. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When a specific manufacturer's warranty is required by the Specifications, the Contractor shall state in writing to the Architect that all the manufacturer's requirements for the issuance of the warranty has been completed and that the Work is ready for the Architect's and Owner's inspection. All manufacturer's warranties required for the Work shall commence as of the Date of Substantial Completion stated on the certificate issued by the Architect.

§ 9.8.3 Upon receipt of the Contractor's ~~list,~~ list and the documents required by Section 3.12.11 neatly bound and indexed, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize ~~the Work or designated portion thereof for its intended use,~~ the Work, and the Work is Substantially Complete, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.3.1 Time for Completion of Items on List and Remedies. The Contractor shall complete all items on the list accompanying the Architect's Certificate of Substantial Completion by the Date of Final Completion set forth in the Owner-Contractor Agreement for the Project. If the Contractor fails to do so, the Owner in its discretion may perform the Work by itself or others and the cost thereof shall be charged against the Contractor. If the balance of the Contract Sum is insufficient, the Contractor will pay the Owner the balance on demand. The Contractor's warranties and obligations under the Contract Documents shall remain in full force and effect and cover any remedial work even if performed by others. If more than one inspection by the Architect for purposes of evaluating corrected Work is required, the Contractor shall pay the additional costs and expenses incurred by the Owner as a result of more than one inspection by the Architect, and the Owner may withhold from sums due or coming due the Contractor amounts to cover such additional costs and ~~§-expenses.~~

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and consistent with Section 9.8.3.1 shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 ~~The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of~~ Upon receipt of the Certificate of Substantial Completion from the Architect and consent of the Contractor's surety if any, the Owner shall make payment of retainage applying to the such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the ~~Contractor, Contractor and/or~~ with the Architect's approval, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. In the event of a disagreement about such responsibilities, correction period, or commencement of warranties, the Architect will resolve the disagreement, and the Architect's decision will be final and binding. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the ~~Architect.~~ Architect, which shall be final and binding.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, ~~Payment and a properly completed Contractor's Payment Application Checklist (if required), all the documentation required to be submitted with such Checklist, and any other supporting documentation required by the Contract Documents or by the Architect,~~ the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, including all required documents submitted, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis

of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. Final Completion is defined in Paragraph 1.1.14 herein.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in ~~effect~~, effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

Unless otherwise provided in the Contract Documents, the final Application for Payment shall be itemized, and the Contractor shall ensure that the final Application for Payment transmitted to the Architect also is accompanied by the following additional documents, if not previously delivered to the Architect:

- .1 Evidence that all Completion/Punchlist items have been completed;
- .2 Where applicable, keys and keying schedule;
- .3 The documents, including as-built set of Drawings and Specifications, referred to in Section 3.3.4 in both hard copy and electronic file (in the format requested by the Owner) not otherwise required by the Contract Documents to be delivered earlier; and
- .4 Other documents required by the Contract Documents.

§ 9.10.3 If, after Substantial Completion of the Work, ~~final completion~~ Final Completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting ~~final completion~~, Final Completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from or related to:

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final ~~payment~~ payment;
- or
- .5 any claims, damages, losses, or expenses for indemnification under Section 3.18.1.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a material supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the ~~Contract~~Contract, including compliance with OSHA and other state and federal regulations applicable to the Work. The Contractor's safety program shall be written and a copy maintained at the Project site for inspection, upon request. Neither the Owner nor the Architect accept any responsibility or liability for the safety of the Contractor's employees or for enforcing the Contractor's safety program. Additionally, the Contractor shall comply with the Owner's rules, regulations, and policies.

§ 10.2 Safety and Health of Persons and Property

§ 10.2.1 The Contractor shall take all reasonable precautions for safety and health of, and shall provide reasonable protection to prevent damage, injury, or loss to

- 1 employees on the Work and other persons who may be affected ~~thereby~~thereby, including the Owner's employees, employees of other contractors, their subcontractors, material suppliers, and persons on the site or adjoining property;
- 2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a ~~Sub-subcontractor~~Sub-subcontractor and/or the Work of any other contractor and the materials and equipment to be incorporated in such Work; and
- 3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards. The Contractor shall be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. The Contractor shall not bring any hazardous materials onto the Project site unless expressly required by the Contract Documents.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. ~~The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is~~ 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18. In the event of a dispute about who is responsible for damage and loss to such property, the issue shall be submitted to the Architect and the Architect's decision shall be final and binding on the respective parties.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party ~~the Contractor~~ suffers injury or damage to person or property because of an act or omission of the other party, Owner, or of others for whose acts such party is legally responsible, ~~notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.~~ the Owner is legally responsible, the Contractor shall submit a Statement of Claim Form for such injury or damage as required by Section 15.1.2.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and ~~notify~~ report the condition to the Owner and Architect of the condition in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, ~~Documents upon written request, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the such material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (i) the Owner causes remedial work to be performed that results in the hazardous substance being rendered harmless; (ii) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (iii) the Work may safely and lawfully proceed using appropriate protective measures, as determined by a competent person employed by the Owner. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up. The term "rendered harmless" shall be interpreted to mean that exposure levels of asbestos and polychlorinated biphenyl (PCB) are less than any applicable exposure standards set forth in OSHA regulations.~~

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, 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 in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity. ~~[Not Used.]~~

§ 10.3.4 The Owner shall not be responsible ~~under this Section 10.3~~ for hazardous materials or substances the Contractor brings to the site unless such materials or substances are expressly required by the Contract Documents. Hazardous materials shall be identified by a Material Safety Data Sheet (MSDS). These MSDS's shall be submitted by the Contractor to the Owner prior to that material being used on the Project. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 ~~The Contractor shall~~ In addition to the Contractor's obligations in Section 3.18 and elsewhere in the Contract Documents, the Contractor shall indemnify and reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently

handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred. [Not Used.]

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, without special instructions or authorization, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7. Nothing in this section will be construed as relieving Contractor from the cost and responsibility for emergencies covered hereby, which with normal diligence, planning, and the close supervision of the Work as required under the Contract, could have been foreseen or prevented. Contractor will provide Owner a list of names and telephone numbers of the designated employees for each Subcontractor to be contacted in case of emergency during non-working hours. A copy of the list will also be displayed on the jobsite.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from from and maintain in an insurance company or insurance companies lawfully authorized to issue insurance in approved by the Owner and licensed to do business in the State of Ohio such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

1. Claims under workers' compensation, disability benefit, and other similar employee benefit acts that are applicable to the Work to be performed;
2. Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
4. Claims for damages insured by usual personal injury liability coverage;
5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
6. Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
7. Claims for bodily injury or property damage arising out of completed operations, which coverage shall be maintained for no less than five (5) years following final payment; and
8. Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents. **§ 11.1.2** The insurance required by Section 11.1.1 shall include at least the specific coverages and be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, written on an occurrence basis, shall be maintained without interruption from the Date of Commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.2.1 The minimum limits of liability for the required policies shall be not less than the following, unless a greater amount is required by law:

- .1 Commercial General Liability ("CGL"): Bodily injury (including death and emotional distress) and property damage with limits of \$ 1,000,000 each occurrence and \$ 2,000,000 aggregate. CGL shall include: (i) Premises-Operations, (ii) Explosion and Collapse Hazard, (iii) Underground Hazard, (iv) Independent Contractors' Protective, (v) Broad Form Property Damage, including Completed Operations, (vi) Contractual Liability, (vii) Products and Completed Operations, (viii) Personal/Advertising Injury, (ix) Stopgap liability with Ohio Intentional Tort endorsement for \$1,000,000 limit, (x) per project aggregate endorsement, and (xi) an endorsement redefining "occurrence" to include property damage arising from the faulty workmanship performed by the Contractor or on the Contractors' behalf by Subcontractors.
- .2 Automobile Liability, covering all owned, non-owned, and hired vehicles used in connection with the Work: Bodily injury (including death and emotional distress) and property damage with a combined single limit of \$1,000,000 per person and \$2,000,000 each accident.
- shall provide surety bonds of .3 Workers' compensation with policy limits as established by Ohio law. Contractor's Workers' Compensation policy shall include a waiver of subrogation.

the types, § 11.1.2.2 Such policies shall be supplemented by an umbrella policy in the amount of \$5,000,000 each occurrence and \$5,000,000 aggregate.

§ 11.1.2.3 The Contractor shall maintain Pollution Liability insurance with a limit for any one incident of not less than \$1,000,000 and an aggregate limit of not less than \$2,000,000.

such penal sums, and subject to such terms and conditions as § 11.1.2.4 By requiring such insurance and insurance limits herein, the Owner does not represent that coverage and limits will necessarily be adequate to protect the Contractor, and such coverage and limits shall not be deemed as a limitation on the Contractor's liability under the indemnities granted to the Owner.

required by § 11.1.2.5 All insurance policies required in Section 11.1 shall be written on an occurrence basis.

the Contract Documents. § 11.1.2.6 Products and completed operations coverage shall commence with the certification of the final Certificate for Payment to the Contractor and extend for not less than five (5) years beyond that date. The Contractor will furnish the Owner and each other additional insured identified in the General Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to the Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

The Contractor shall purchase § 11.1.2.7 The Contractor shall require all Subcontractors to provide Workers' Compensation, CGL, and Automobile Liability insurance with the same minimum limits specified herein, unless the Owner agrees to a lesser amount.

§ 11.1.2.8 All liability policies required in Section 11.1 shall include an additional insured endorsement naming the Owner and Architect, and any other individuals or entities identified in these General Conditions, all of whom shall be listed as additional insured, and include coverage for the respective officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insured. The additional insured endorsement shall be ISO 20 10 11 85 or its equivalent so that Completed Operations liability extends to the additional insureds.

§ 11.1.2.9 All liability policies required in Section 11.1 shall be primary and non-contributory.

§ 11.1.2.10 All liability policies required in Section 11.1 must include contractual liability insurance covering the Contractor's indemnity obligations.

and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where § 11.1.3 Certificates of insurance acceptable to the Owner, copies of endorsements, and other evidence of insurance requested by the Owner or any other additional insured, prior to commencement of the Work, shall be delivered to the Owner with copies to each additional insured identified in these General Conditions, when the Contractor delivers the executed counterparts of the Agreement to the Owner and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled, materially

changed with respect to coverage for the Project, or allowed to expire until at least 30 days' prior written notice has been given to the Owner and Contractor and to each other additional insured identified in the General Conditions to whom a certificate of insurance has been issued. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness. Prior to commencing the Work, the Contractor shall provide the Owner with the specific additional insured endorsement that names the Owner as well as copies of the waiver of subrogation and primary and contributory endorsements.

the Project is located. § 11.1.3.1 Prior to commencing the Work, the Contractor shall furnish to the Owner, through the Architect, one copy of each of the Certificates of Insurance required herein. The Certificates of Insurance shall specifically set forth evidence of all coverage required by Section 11.1. The form of certificate shall be the form prescribed by the Owner, which shall be the ACORD Form 25 (2009/09 or more recent) with AIA Document G-715 "Supplemental Attachment" attached thereto. The Contractor shall furnish to the Owner copies of any endorsement that is subsequently issued by amending coverage or limits.

§ 11.1.3 Upon the request of any person 11.1.4 In no event will any failure of the Owner to receive certified copies or certificates of policies required under Section 11.1 or to demand receipt of such certified copies or certificates prior to the Contractor's commencing the Work be construed as a waiver by the Owner or the Architect of the Contractor's obligations to obtain insurance pursuant to this Article 11. The obligation to procure and maintain any insurance required by this Article 11 is a separate responsibility of the Contractor and independent of the duty to furnish a certified copy or certificate of such insurance policies.

or entity appearing to be § 11.1.5 If the Contractor fails to purchase and maintain, or require to be purchased and maintained, any insurance required under Section 11.1, the Owner may but shall not be obligated to, upon five (5) days written notice to the Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand.

a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy § 11.1.6 When any required insurance, due to the attainment of a normal expiration date or renewal date expires, the Contractor shall supply the Owner with Certificates of Insurance and amendatory riders or endorsements that clearly evidence the continuation of all coverage in the same manner, limits of protection, and scope of coverage as was provided by the previous policy. In the event any renewal or replacement policy, for whatever reason obtained or required, is written by a carrier other than that with whom the coverage was previously placed, or the subsequent policy differs in any way from the previous policy, the Contractor shall also furnish the Owner with a certified copy of the renewal or replacement policy unless the Owner provides the Contractor with prior written consent to submit only a Certificate of Insurance for such policy. All renewal and replacement policies shall be in form and substance satisfactory to the Owner and written by carriers acceptable to the Owner.

§ 11.1.7 Any aggregate limit under the Contractor's liability insurance shall, by endorsement, apply to the Project separately.

§ 11.1.8 The Contractor shall require each of its Subcontractors to (i) procure insurance reasonably satisfactory to the Owner and (ii) name the Owner and Architect, and any of their employees and agents, as additional insured under the Subcontractor's CGL policy. The additional insured endorsement included on the Subcontractor's CGL policy shall state that coverage is afforded the additional insureds with respect to claims arising out of operations performed by or on behalf of the Contractor. If the additional insured have other insurance that is applicable to be furnished the loss, such other insurance shall be on an excess or contingent basis. The amount of the insurer's liability under this insurance policy shall not be reduced by the existence of such other insurance.

§ 11.1.4 11.1.9 **Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage

arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Liability Insurance

§ 11.2.1 The Owner-Owner, at the Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance.

§ 11.2.2 [Not Used.]

§ 11.2.3 [Not Used.]

§ 11.3 Property Insurance

shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required **§ 11.3.1 Builder's Risk Insurance**. The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy for the Project in the amount of the initial Contract Sum, plus value of subsequent contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such builder's risk insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors, and Sub-subcontractors in the Project.

insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. **§ 11.3.1.1** The builder's risk insurance obtained shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in **§ 11.3.1.1** If applicable, property insurance provided by the Owner shall not cover any tools, apparatus, machinery, scaffolding, hoists, forms, staging, shoring, and other similar items commonly referred to as construction equipment that may be on the site and the capital value of which is not included in the Work, nor shall such insurance cover any materials or equipment before these materials and equipment are physically incorporated into the Work. The Contractor shall make its own arrangements for any insurance it may require on such construction equipment and materials and equipment. Any policy obtained by the Contractor under this Section 11.3 and related sections shall include a waiver of subrogation in accordance with the requirements of Section 11.3.7. If the Work is located in a Special Flood Hazard Area, as defined by the Federal Emergency Management Agency, the Contractor shall provide an endorsement to the property insurance policy that provides coverage for physical loss or damage caused by flood.

the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, **§ 11.3.1.2** When it is available, the party providing the builder's risk insurance shall provide to the other party with written proof of the builder's risk insurance upon written request.

the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When **§ 11.3.1.3** If the property insurance requires deductibles, the Owner shall pay such deductibles, however, that if the cause of any loss payment under such insurance or self-insurance is the fault of Contractor, the Contractor shall pay such deductible.

the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event § 11.3.1.4 The builder's risk insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged § 11.3.1.5 This property insurance must allow for partial utilization of the Work by the Owner and shall contain no partial occupancy restriction for the Project by the Owner. Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurers providing the property insurance pursuant to Section 11.3 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurance company or companies providing property insurance shall consent to such partial occupancy or use by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any partial use or occupancy.

to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs § 11.3.1.6 Damages to Other Property. The maintaining of such insurance as outlined in Section 11.1 shall in no way constitute a waiver of the Contractor's legal liability for damage to any adjoining buildings or existing buildings or their contents or the Work and property of others on the site beyond the limits of insurance thus maintained. The Contractor shall hold the Owner free and harmless from any injury and damage resulting from the negligent or faulty performance of the Contract by the Contractor or its Subcontractors or others under its control or direction.

and damages attributable thereto. § 11.3.1.7 This property insurance must include testing and startup.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration 11.3.2 Boiler and Machinery Insurance. The Owner, at the Owner's option, may purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Work, and the Owner and Contractor and any other individuals or entities identified in the Contract Documents and the officers, directors, partners, employees, agents, and consultants of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless § 11.3.3 Loss of Use Insurance The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by § 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by § 11.3.5 If during the Project construction period the Owner insures properties, real or personal, or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.8 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost **§ 11.3.6** The Owner shall maintain copies of the policies of insurance it is required to purchase and maintain hereunder at its offices and shall permit the Architect or the Contractor to inspect the policies during normal business hours and upon reasonable advance written notice.

of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance. **§ 11.3.7** All policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Section 11.3 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to the Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with these General Conditions.

§ 11.3-11.3.8 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement of actual recovery of any insurance proceeds under any property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Project, Work, except such rights as they have to proceeds of such insurance. insurance held by the Owner in good faith. The Owner or Contractor, as appropriate, shall ~~require similar written waivers require, by appropriate agreements, similar written waivers each~~ in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, ~~subcontractors, and sub-subcontractors.~~ The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This if any, and the subcontractors, sub-subcontractors, agents, and employees of any of them. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) and whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

~~§ 11.5.1-11.3.9~~ A loss insured under the Owner's property insurance required by the Agreement shall be adjusted by the Owner as fiduciary in good faith and made payable to the Owner as fiduciary in good faith for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor **11.3.10.** The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. **11.3.10** The Owner in good faith shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within fifteen days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved as provided in Sections 15.3 and 15.4. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner in good faith shall make settlement with insurers, or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner **§ 11.3.11** If required in writing by a party in interest, the Owner in good faith shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received in good faith. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.4. Performance Bond and Payment Bond

Contractor shall execute a Change Order for reconstruction of the damaged **§ 11.4.1** The Contractor shall provide a contract bond to guaranty payment and performance of the Work, as required by Ohio law. When the Contractor delivers the executed counterparts of the Agreement to the Owner, the Contractor shall deliver such bond to the Owner, along with other documents as may be required.

or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement **§ 11.4.1.1** If the surety on any bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet with the requirements of the Agreement or Ohio law, the Contractor shall promptly notify the Owner and the Architect and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of the Contract Documents and Ohio law.

or the allocation of the proceeds, **§ 11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work. **§ 11.4.3 Material Default or Termination.** If the Owner notifies the Contractor's surety that the Contractor is in material default or terminates the Contract, the surety will promptly and within 21 days investigate the claimed material default or termination. If the Owner gives a notice of material default and then terminates the Contract, the surety shall complete its investigation within 21 days of the notice of material default. As part of such investigation, the surety shall visit the offices of the Contractor, Architect, and Owner to review the available project records. If the surety proposes to take over the Work, the surety shall do so no later than the expiration of such 21 day period or 10 days after the date the Owner terminates the Contract, whichever is later. If the Owner terminates the Work, and the surety proposes to provide a replacement contractor, the replacement contractor shall be fully capable of performing the Work in accordance with the Contract Documents, including meeting all the requirements of the Contract Documents. If the Contractor is terminated, the replacement contractor shall not be the Contractor. The surety will provide the Owner with the results of its investigation, including any written report or documents. This Section 11.4.3 is in addition to the Owner's rights under Section 14.2.2 and is not intended to create any rights of the surety, including but not limited to the right to takeover the Contractor's obligations.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. Costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, such costs and the cost of correction, shall be at the Contractor's expense. Correction shall be at the Contractor's expense unless the condition was caused by the Owner or a Separate Contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The In addition to the rights and remedies under Section 2.5, the Contractor shall promptly correct Work rejected by the Architect or Owner for failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of begin to correct it within 2 business days after receipt of written notice from the Owner to do so, so and complete such correction within 30 days after receipt of such notice, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period 30 days after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and does not limit any warranty period under these Contract Documents, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the

time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made. Any such acceptance shall be in writing and executed by a representative of the Owner who has been expressly authorized to do so.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, ~~excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.~~located.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 ~~No-Except as otherwise provided in the Contract Documents, no action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.~~

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall provide proper facilities at all times for inspections and tests of work by the Owner and other authorities having jurisdiction over the Project. The Contractor shall remove any water used in conducting such tests and inspections in a manner so as not to discharge the water on any portions of the Work or damage any portion of the Work. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for the Agreement is executed, and (2) tests, inspections, or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

~~so require.~~ **§ 13.4.1.1** If Laws and Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, the Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish the Architect the required certificates of inspection or approval.

The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures.

§ 13.4.1.2 The Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for the Owner's and Architect's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to the Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to the Owner and Architect. Tests required by the Contract Documents to be performed by the Contractor that require test certificates to be submitted to the Owner or Architect for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:

1. "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.
2. Basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction" as applicable.
3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Institute of Standards and Technology or accepted values of natural physical constants.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense. Neither the observations by the Owner or its designated representative, nor inspections, tests, or approvals by persons other than the Contractor, shall relieve the Contractor from its obligations to perform the Work in accordance with the Contract Documents.

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

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at zero percent (0%).

§ 13.6 Time Limits on Claims. As between the Owner and Contractor, the statute of limitations shall commence as provided in current Ohio law.

§ 13.7 Attorney-Client Confidential and Privileged Communications. The Contractor acknowledges and agrees that the Owner's legal counsel may from time to time provide legal services to the Project and that in doing so may communicate with the Architect. The Contractor agrees that such communications will be privileged communications and, if there is a Claim contemplated or pending, any written communications will be confidential work product.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of ~~30-90~~ consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the ~~Work~~, Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the ~~Work~~, Work under direct or indirect contract with the Contractor, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, ~~as well as including~~ reasonable overhead and profit on Work ~~not~~ executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract ~~Documents~~ Documents, including but not limited to failure to maintain the Construction Schedule or failure to correct defective and/or non-conforming Work.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, ~~and upon certification by the Architect that sufficient cause exists to justify such action~~, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the ~~surety~~ surety as expressly stated in the applicable surety bond:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

As set forth in this section, the Owner's termination of the Contractor is without prejudice to any other rights and remedies of the Owner, including but not limited to the Owner's rights and remedies under the Contract Document and at law, all of which shall survive termination.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other costs or damages incurred by the Owner and not expressly waived, including but not limited to the Owner's attorneys' and consultants' fees and expenses, arising out of or related to the termination, such excess shall be paid to the Contractor. If such ~~costs~~ costs, other costs, and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 ~~The~~ Upon three business days written notice to the Contractor and Architect, the Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, ~~the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~ Contractor shall be entitled to receive payment for Work properly executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The Contractor's Claims must be initiated by submitting the Statement of Claim Form ("Claim Form") included with the Contract Documents to the Architect and the Owner, properly completed in accordance with the instructions accompanying the Form and submitted within the time period under Section 15.1.3.1. The responsibility to substantiate Claims shall rest with the party making the Claim. The Contractor shall not knowingly present or cause to be presented to the Owner a false or fraudulent Claim. "Knowingly" shall have the same meaning as in Section 3729(b) USC of the Federal False Claims Act. If the Contractor knowingly presents or causes to be presented a false or fraudulent Claim, then the Contractor shall be liable to the Owner for the same civil penalty and damages as the

United States Government would be entitled to recover under such Section 3729(a) USC and shall also indemnify and hold the Owner harmless from all costs and expenses, including the Owner's attorneys' and consultants' fees and expenses incurred in investigating and defending against such Claim and in pursuing the collection of such penalty, damages, and fees and expenses. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2. Contractor acknowledges and agrees that the Owner and/or parties in privity of contract with the Owner may delay, interfere with, and/or disrupt the Work of the Contractor, and such actions do not constitute a breach of contract by the Owner, since the Contractor is entitled to additional compensation by properly submitting and pursuing a Claim as permitted by these General Conditions. Pending final resolution of the Claim, the Contractor shall continue performance of the Work as provided in Section 15.1.4.

§ 15.1.2 [Not Used.]

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and As a condition precedent to a change in the Contract Sum or the Contract Times, for each Claim the Contractor shall deliver a fully completed Statement of Claim Form, a copy of which form is a Contract Document, to the Initial Decision Maker with a copy sent to the Owner and the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence Maker, within 10 days of the start of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later the Claim. The Contractor shall be responsible for substantiating its Claim. The Contractor's failure to deliver a fully completed Statement of Claim form shall be an irrevocable waiver of the Contractor's right to any form of additional compensation, be it in time or money, arising out of the Claim or the circumstances underlying the Claim. Further, the Contractor's obligation to deliver a fully completed Statement of Claim form within such 10 day period is a material term of the Contract Documents and provides the Owner with the opportunity to mitigate its damages.

§ 15.1.3.2 Claims by either the Owner or Contractor, the Owner, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decision decisions of the Initial Decision Maker.

§ 15.1.4.2 [Not Used.]

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. the Contractor shall submit a Statement of Claim Form as required by Section 15.1.3.1. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. Time following proper Notice of Delay as required under Section 3.10.3.1 of these General Conditions, the Contractor shall submit a Statement of Claim Form as required by Section 15.1.3.1.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented. The Contractor is prevented from completing any part of the Work within the Contract Time due to weather conditions and the Contractor wants additional time to complete the Work, the Contractor shall initiate a Claim by submission of the Claim Form in accordance with Section 15.1.3.1. The Contractor's entitlement to additional time shall be evaluated and substantiated as provided in Section 15.1.6.2.1.

by data substantiating that **§ 15.1.6.2.1 Weather Delays.** When the Contractor is prevented from completing any part of the Work on the critical path within the Contract Time due to weather conditions, provided the Contractor properly initiates a Claim, the Contract Time will be extended by one (1) day for each work day lost due to weather that delays Work on the critical path in excess of those in the following table:

Month	Number of Workdays Lost Due to Weather
January	8
February	8
March	7
April	6
May	5
June	4
July	4
August	4
September	5
October	6
November	6
December	6

weather conditions were abnormal **§ 15.1.6.3 Excusable and Compensable Delays.** The delays for which the Contractor is entitled to additional time are "Excusable Delays." The only Excusable Delays are delays which the Contractor establishes were: (a) caused by the Owner or those in privity of contract with the Owner, (b) physical damage to the Project over which the Contractor has no control, (c) labor disputes beyond the control of the Contractor, (d) work days lost due to weather conditions as provided under Section 15.1.6.2, and (e) concealed or unknown conditions under Section 3.7.4.

for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction. The delays for which the Contractor is entitled to additional time and money are "Compensable Delays." The only Compensable Delays are Excusable Delays which the Contractor establishes were proximately caused by an improper action or failure to act by the Owner.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other. The Contractor waives Claims against the Owner for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- 1—damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- 2—damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, waiver is applicable without limitation, to all consequential damages due to either party's termination or the Owner's termination of the Agreement in accordance with Article 14. Nothing contained in

this Section 15.1.7 shall be deemed to preclude ~~assessment~~ an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.1.8 Settlement Offers. If the Contractor initiates a Claim, the Owner may make settlement offers to settle the Claim at any time up to the date of the trial. Such settlement offers shall be subject to Rule 408 (Compromise and Offers of Compromise) of the Ohio Rules of Evidence. If at any stage of the litigation, including any appeals, the Contractor's Claim is dismissed or found to be without merit, or if the damages awarded to the Contractor on its Claim do not exceed the Owner's last settlement offer, the Contractor shall be liable to the Owner and shall reimburse the Owner for all of the Owner's attorneys' fees and expenses, and arising out of or related to such Claim since the date of such last settlement offer.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, ~~and 11.5, 11.3.8, and 11.3.10,~~ shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to ~~mediation of any Claim. If an initial decision has not been rendered within 30 days any further proceeding permitted under these General Conditions of~~ any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker, ~~the party asserting the Claim may demand mediation and binding dispute resolution.~~ ~~Maker~~ without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ~~ten~~ thirty (30) days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.2.1 Owner's Request for Documents. The Owner may request such documents and information from the Contractor as the Owner determines necessary to evaluate and comment upon the Claim. Upon receipt of such request from the Owner, the Contractor shall provide all requested documents and information within ten (10) days. Such documents and information may include but not be limited to the Contractor's Project accounting records, estimate for the Project, daily job logs, and other information from which the Contractor's Project costs may be derived. The Contractor shall provide the requested documents in the formats requested, which include both paper and electronic copies. If requested by the Owner, the electronic copies shall be provided in native computer language. To the extent permitted by law, the Owner shall keep the Project accounting records and estimate for the Project confidential. The Contractor's provision of the requested documents to the Owner in the format requested by the Owner shall be a condition precedent to any further proceeding under the Contract Documents.

Failure to provide the requested documents shall be a material breach of the Contract, and the Contractor shall indemnify the Owner for all of the Owner's costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the Contractor's failure to comply with this provision. If the Contractor fails to provide the requested documents, the Contractor shall be precluded from presenting such documents in any subsequent dispute resolution proceedings, if the data was reasonably available at the time of the request.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a

response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part. If the Initial Decision Maker requests supporting data from a party and the party fails to provide it, the party thereafter shall be precluded from presenting such data in any subsequent dispute resolution proceedings, if the data was reasonably available to it at the time of the request.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, ~~if the parties fail to resolve their dispute through mediation, to binding dispute resolution.~~ if both parties agreed in writing to mediate and, if mediation is not successful in resolving the matter or the parties do not agree to mediate, litigation in accordance with Section 15.4.1.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 ~~Either party may, If the Contractor does not request mediation of a written decision of the Initial Decision Maker, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision, then the Initial Decision Maker's decision becomes final and binding upon the Contractor. If the Initial Decision Maker renders a decision after litigation has been initiated, such decision may be entered as evidence, but shall not supersede the litigation proceedings unless the decision is acceptable to all parties concerned. Litigation shall be considered "initiated" upon either the service of the original complaint on the Owner or, if litigation relating to the Project has already been filed, when a motion for leave to amend the complaint to add the claim has been filed.~~

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 If both Parties agree to mediate, in writing, then Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 ~~The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~ may, after initial decision by the Initial Decision Maker or 30 days after submission of the Claim to the Initial Decision Maker, be subject to mediation, pursuant to mediation procedures mutually agreed-upon by the Parties.

§ 15.3.2 [Not Used.]

§ 15.3.3 ~~Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to~~

~~file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.~~[Not Used.]

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place county where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration~~Litigation~~

§ 15.4.1 ~~If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any~~ Any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. ~~The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded by mediation or any Claim that is not subject to mediation, shall be subject to litigation unless both parties mutually agree in writing to arbitrate the Claims. Venue for such litigation shall be exclusive in the state court of competent jurisdiction in the Court of Common Pleas, Greene County, Ohio. The parties expressly waive the right to remove any litigation to federal court. Any Claim subject to, but not resolved by, mediation may be~~

§ 15.4.1.1 ~~A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim decided by arbitration if the parties mutually agree in writing. There shall be no mandatory arbitration of Claims.~~

§ 15.4.1.1 [Not Used.]

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.[Not Used.]

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.[Not Used.]

§ 15.4.4 Consolidation or Joinder [This Section is deleted in its entirety.]

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).[Not Used.]

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.[Not Used.]

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.[Not Used.]

BID FORM

1.01 BID SUBMITTED BY:

(Contractor)

Date bid submitted: _____

1.02 DELIVER TO:

**Beavercreek Township Fire Department
ATTN: Amy Hiles
851 Orchard Lane
Beavercreek, Ohio 45434**

1.03 Having carefully reviewed the Instructions to Bidders, Drawings, Specifications and other Contract Documents for the Project titled **Fire Station No. 65 Project** including having also received, read, and taken into account the following Addenda:

Addendum No.	Dated
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

and likewise having inspected the site and the conditions affecting and governing the Project, the undersigned hereby proposes to furnish all materials and to perform all labor, as specified and described in the said Specifications and/or as shown on the said Drawings for all Work necessary to complete the Project on a timely basis and in accordance with the Contract Documents regardless of whether expressly provided for in such Specifications and Drawings.

1.04 Before completing the Bid Form, the undersigned represents that it has carefully reviewed the Request for Bids, Instructions to Bidders, this Bid Form, Form of Bid Guaranty and Contract Bond, Contractor's Affidavit (O.R.C. 5719.042), Owner-Contractor Agreement, General Conditions of the Contract (AIA A201, 2017) (as modified for the Project), Drawings, Project Specifications, and other Contract Documents. Failure to comply with provisions of the Contract Documents may be cause for disqualification of the bid.

1.05 **BONDS AND CONTRACT:** If the undersigned is notified of bid acceptance, it agrees to furnish required bonds as indicated in the Instructions to Bidders.

1.06 **COMPLETION OF WORK:** In submitting a bid, the undersigned agrees to execute the Owner-Contractor Agreement in the form included in the Contract Documents and to complete its Work as required by the Contract Documents.

NOTE A: The wording of the Bid Form shall be used throughout, without change, alteration, or addition. Any change may cause it to be rejected.

NOTE B: Bidder is cautioned to bid only on the Brands or Standards specified.

NOTE C: If there is an inconsistency or conflict in the Bid amount, the lowest amount shall control, whether expressed in numbers or words.

2.01 BID:

Include the cost of all labor and material for the contract listed below. Bidder is to fill in all blanks related to the Bid Package for which a bid is being submitted. If no bid is submitted for an item, leave the item blank or insert "NO BID" in the blank. For alternate items, indicate whether the amount stated is in addition to or a deduction from the base bid amount (if there is no indication whether the amount for an alternate is an addition or a deduction, the amount shall be a deduction).

2.02 The estimated cost of the Allowances for the Project are as follows:

Allowance Description		Cost
1	Winter protection allowance to cover concrete slab with insulating blankets and temporary heat and tenting for masonry work	\$ _____

2.03 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Lump Sum – All work, including any Allowances but not including unit price work or alternates.

_____ Dollars (\$ _____)
 (Words) (Figures)

2.04 Alternates

Alternate Description		Add or Deduct	Cost in Words	Cost in Figures
G-1	Provide all labor and materials to provide a standing seam metal roof and snow guards in lieu of asphalt shingles	Add		\$ _____
C-1	Deduct alternate to provide all labor and material to construct the site without the bypass driveway and include all necessary grass seeding of the area	Deduct		\$ _____

2.05 Unit Prices: Bidder is to include the cost of all labor and material for the Project in the Unit Prices listed below. The Owner will verify the accurate mathematical totaling of all Bid amounts provided. In the event that there are any mathematical errors in the Unit Prices, as determined by owner, each individual unit price will control over the lump sum total. If there are undercuts directed by the Design Professional, such Work will be paid for in accordance with the Unit Prices bid below:

Unit Price Description		Unit Price in Words	Unit Price in Figures
No. 1	Removal of unsatisfactory soil material and replace with satisfactory fill	_____ Dollars per _____	\$ _____ per _____
No. 2	Rock excavation and replacement with satisfactory soil material	_____ Dollars per _____	\$ _____ per _____
No. 3	Removal of unsatisfactory soil and replacement with low-strength concrete (lsm or clsm)	_____ Dollars per _____	\$ _____ per _____
No. 4	Provide and place lime for the purpose of drying wet soils	_____ Dollars per _____	\$ _____ per _____
No. 5	Provide and place 304 gravel	_____ Dollars per _____	\$ _____ per _____

2.06 Proposed Date for Substantial Completion: _____ calendar days from the Date of Commencement.

3.01 INSTRUCTIONS FOR SIGNING

- A. The person signing for a sole proprietorship must be the sole proprietor or his authorized representative. The name of the sole proprietor must be shown below.
- B. The person signing for a partnership must be a partner or his authorized representative.
- C. The person signing for a corporation must be the president, vice president or other authorized representative; or he must show authority, by affidavit, to bind the corporation.
- D. The person signing for some other legal entity must show his authority, by affidavit, to bind the legal entity.

4.01 BIDDER CERTIFICATIONS. The Bidder hereby acknowledges that the following representations in this bid are material and not mere recitals:

1. **The Bidder acknowledges that this is a public project involving public funds, and that the Owner expects and requires that each successful Bidder adhere to the highest ethical and performance standards. The Bidder by submitting its bid pledges and agrees that (a) it will act at all times with absolute integrity and truthfulness in its dealings with the Owner and the Design Professional, (b) it will use its best efforts to cooperate with the Owner and the Design Professional and all other Contractors on the Project and at all times will act with professionalism and dignity in its dealings with the Owner, Design Professional and other Contractors, (c) it will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are**

assigned to him/her, and (d) it has read, understands and will comply with the terms of the Contract Documents.

2. The Bidder represents that it has had a competent person carefully and diligently review each part of the Contract Documents, including any Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work on which the Bidder is submitting its bid. By submitting its bid, each Bidder represents and agrees, based upon its careful and diligent review of the Contract Documents, that it is not aware of any conflicts, inconsistencies, errors or omissions in the Contract Documents for which it has not notified the Design Professional in writing at least seven (7) days prior to the bid opening. If there are any such conflicts, inconsistencies, errors or omissions in the Contract Documents, the Bidder (i) will provide the labor, equipment or materials of the better quality or greater quantity of Work; and/or (ii) will comply with the more stringent requirements. The Bidder will not be entitled to any additional compensation for any conflicts, inconsistencies, errors or omissions that would have been discovered by such careful and diligent review, unless it has given such prior written notice to Design Professional.
3. The Bidder represents that it has had a competent person carefully and diligently inspect and examine the entire site for the Project and the surrounding area, including all parts of the site applicable to the Work for which it is submitting its bid, and carefully correlated the results of the inspection with the requirements of the Contract Documents. The Bidder agrees that its bid shall include all costs attributable to site and surrounding area conditions that would have been discovered by such careful and diligent inspection and examination of the site and the surrounding area, and the Bidder shall not be entitled to any Change Order, additional compensation, or additional time on account of conditions that could have been discovered by such an investigation.
4. The Bidder represents, understands and agrees that a) the Claim procedures in the General Conditions as modified for the Project are material terms of the Contract Documents, b) if it has a Claim, it will have its personnel provide complete and accurate information to complete and submit the Statement of Claim form on a timely basis, c) the proper completion and timely submission of a Statement of Claim form is a condition precedent to any change in the Contract Sum or the Contract Time(s), and d) the proper and timely submission of the Statement of Claim form provides the Owner and the Design Professional with necessary information so that the Owner may investigate the Claim and mitigate its damages.
5. The Bidder represents that the bid contains the name of every person interested therein and is based upon the Standards specified by the Contract Documents.
6. The Bidder and each person signing on behalf of the Bidder certifies, and in the case of a bid by joint venture, each member thereof certifies as to such member's entity, under penalty of perjury, that to the best of the undersigned's knowledge and belief: (a) the Base Bid, any Unit Prices and any Alternate bid in the bid have been arrived at independently without collusion, consultation, communication or agreement, or for the purpose of restricting competition as to any matter relating to such Base Bid, Unit Prices or Alternate bid with any other Bidder; (b) unless otherwise required by law, the Base Bid, any Unit Prices and any Alternate bid in the bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to the bid opening, directly or indirectly, to any other Bidder who would have any interest in the Base Bid, Unit Prices or Alternate bid; (c) no attempt has been made or will be made by the Bidder to induce any other Person to submit or not to submit a bid for the purpose of restricting competition; and (d) the statements made in this Bid Form are true and correct.
7. The Bidder will execute the Owner/Contractor Agreement in the form included with the Contract Documents, if a Contract is awarded on the basis of this bid, and if the Bidder does not execute

the Contract Form for any reason, other than as authorized by law, the Bidder and the Bidder's Surety are liable to the Owner.

8. The Bidder certifies that upon the award of a Contract, the Contractor will ensure that all of the Contractor's employees, while working on the Project site, will not purchase, transfer, use, or possess illegal drugs or alcohol or abuse prescription drugs in any way.
9. The Bidder agrees to furnish any information requested by the Design Professional or the Owner's authorized representative to evaluate that the Bidder has submitted the lowest and best bid and that the bid is responsive to the specifications.
10. The Bidder certifies that it has no unresolved findings for recovery issued by the Auditor of State.
11. The Bidder certifies that it is aware of and in compliance with the requirements of Ohio Revised Code Section 3517.13 regarding campaign contributions.

LEGAL NAME OF BIDDER: _____

BIDDER IS (check one): ☐ sole proprietor ☐ partnership ☐ corporation ☐ other legal entity

NAME & TITLE OF PERSON LEGALLY AUTHORIZED TO BIND BIDDER TO A CONTRACT:

Name	Title
DATE SIGNED: _____	SIGNATURE: _____
	ADDRESS: _____

	TELEPHONE: _____
	FAX: _____
	FEDERAL TAX I.D. # _____

When the Bidder is a partnership or a joint venture, state name and address of each partner in the partnership or participant in the joint venture below:

_____	_____
Name	_____
	Address
_____	_____
Name	_____
	Address
_____	_____
Name	_____

Name

Name

Address

Address

Address

END OF SECTION

CONTRACTOR'S PERSONAL PROPERTY TAX AFFIDAVIT
(O.R.C. § 5719.042)

State of Ohio
County of Greene, ss:

_____, being first duly sworn, deposes and says that he is the
(Name)

_____ of _____, with offices located at
(Title) (Contractor)

_____, and as its duly
(Address of Contractor)

authorized representative, states that effective this _____ day of _____, 20____,

(Name of Contractor)

() is charged with delinquent personal property taxes on the general list of personal property as set forth below:

<u>County</u>	<u>Amount</u> (include total amount penalties and interest thereon)

Greene County	\$ _____

() is not charged with delinquent personal property taxes on the general list of personal property in any Ohio county.

(Affiant)

Sworn to and subscribed this _____ day of _____, 20____. The notarial act certified hereby is a jurat. An oath or affirmation was administered to the signer with regard to the notarial act certified to hereby.

(Notary Public)

My commission expires

_____, 20____

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CONTRACTOR'S QUALIFICATION STATEMENT

SUBMITTED TO:

**Beavercreek Township Fire Department
ATTN: Amy Hiles
851 Orchard Lane
Beavercreek, Ohio 45434**

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

- ☐ Corporation
- ☐ Partnership
- ☐ Individual
- ☐ Joint Venture
- ☐ Other

NAME OF PROJECT:

1. ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

1.2 How many years has your organization been in business under its present business name?

1.2.1 Under what other or former names has your organization operated?

1.3 If your organization is a corporation, answer the following:

1.3.1 Date of incorporation:

1.3.2 State of incorporation:

1.3.3 President's name:

1.3.4 Vice President's name(s):

1.3.5 Secretary's name:

1.3.6 Treasurer's name:

- 1.4 If your organization is a partnership, answer the following:
 - 1.4.1 Date of organization:
 - 1.4.2 Type of partnership (if applicable):
 - 1.4.3 Name(s) of general partner(s):
- 1.5 If your organization is individually owned, answer the following:
 - 1.5.1 Date of organization:
 - 1.5.2 Name of owner:
- 1.6 If the form of your organization is other than those listed above, describe it and name the principals:

2. LICENSING

- 2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.
- 2.2 List jurisdictions in which your organization's partnership or trade name is filed.

3. EXPERIENCE

- 3.1 List the categories of work that your organization normally performs with its own forces.
- 3.2 Claims and Lawsuits (If the answer to any of the questions below is yes, please attach details.)
 - 3.2.1 Has your organization ever failed to complete any work?
 - 3.2.2 Within the last five (5) years has your organization or any of its officers prosecuted any Claims, had any Claims prosecuted against it or them, or been involved in or is currently involved in any mediation or arbitration proceedings or lawsuits suits related to any construction project, or has any judgments or awards

outstanding against it or them? If the answer is yes, please attach the details for each Claim, including the names and telephone numbers of the persons who are parties, the amount of the Claim, the type of Claim and basis for the Claim, and the outcome.

Note: As used in this document "Claim" means a Claim initiated under the Contract Documents for a project.

- 3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? If the answer is yes, please attach details for each instance, including the names and telephone numbers of the persons who are parties to the contract, and the reason(s) the contract was not completed.

- 3.4 On a separate sheet, list construction projects your organization has in progress with an original Contract Sum of more than \$500,000.00, giving the name of project, owner and its telephone number, design professional and its telephone number, contract amount, percent complete and scheduled completion date.

3.4.1 State total amount of work in progress and under contract:

- 3.5 Provide the following information for each contract your organization has had during the last five (5) years, including current contracts, where the Contract Sum is fifty percent (50%) or more of the bid amount for this Project, including add alternates. If there are more than ten (10) of these contracts only provide information on the most recent ten (10) contracts, including current contracts.

Project And Work	Contract Sum	Owner's Representative & Telephone Number	Engineer's Or Architect's Representative Name & Telephone Number

Project And Work	Contract Sum	Owner's Representative & Telephone Number	Engineer's Or Architect's Representative Name & Telephone Number

- 3.5.1 Provide the following information for each project your organization has had during the last five (5) years, which your organization believes is of comparable or greater size and complexity than the Owner's project. If there are more than five (5) of these projects, only provide information on the most recent five (5) projects, including current projects.

Project And Work	Contract Sum	Owner's Representative & Telephone Number	Engineer's Or Architect's Representative Name & Telephone Number

- 3.5.2 State average annual amount of construction work your organization has performed during the last five years.

- 3.5.3 If any of the following members of your organization's management--president, chairman of the board, or any director--operates or has operated another construction company during the last five (5) years, identify the member of management and the name of the construction company.

- 3.5.4 If your organization is operating under a trade name registration with the Secretary of State for the State of Ohio, identify the entity for which the trade name is registered. If none, state "none."

3.5.5. If your organization is a division or wholly-owned subsidiary of another entity or has another relationship with another entity, identify the entity of which it is a division or wholly-owned subsidiary or with which it has another relationship and also identify the nature of the relationship. If none, state "not applicable."

3.6 On a separate sheet, list the construction education, training and construction experience for each person who will fill a management role on the Project, including without limitation the Project Executive, Project Manager, and Project Superintendent. For each person listed, include with the other information the last three projects on which the person worked and the name and telephone number of the Design Professional and the Owner.

4. REFERENCES

4.1 Trade References:

4.2 Bank References:

4.3 Surety:

4.3.1 Name of bonding company:

4.3.2 Name and address of agent:

5. FINANCING

5.1 Financial Statement

5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes); and

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

5.1.2 Name and address of firm preparing attached financial statement, and date thereof.

5.1.3 Is the attached financial statement for the identical organization named on page one?

5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidary).

5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

Certification. The undersigned certifies for the reliance of the Owner that after diligent investigation, to the best of the undersigned's belief, the information provided with this Contractor's Qualification Statement is true, accurate and not misleading.

SIGNATURE

Dated at this ____ day of _____, 20__.

Name of Organization: _____

By: _____[PRINT NAME]

Signature: _____

Title: _____

_____, being duly sworn, deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this ____ day of _____, 20__. The notarial act certified hereby is a jurat. An oath or affirmation was administered to the signer with regard to the notarial act certified to hereby.

Notary Public

My Commission Expires: _____

SEAL

**BID GUARANTY AND
CONTRACT BOND**
(O.R.C. § 153.571)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____
_____ ("Contractor") as principal and _____
_____ as surety are hereby held and firmly bound unto the **Beavercreek
Township Board of Trustees**, as obligee in the penal sum of the dollar amount of the bid submitted by
the principal to the obligee on _____, 20__, to undertake the construction of the **Fire Station
No. 65 Project** ("Project"). The penal sum referred to herein shall be the dollar amount of the principal's
bid to the obligee, incorporating any additive or deductive Alternates made by the principal on the date
referred to above to the obligee, which are accepted by the obligee. In no case shall the penal sum
exceed the amount of _____ Dollars (\$_____). (If the
foregoing blank is not filled in, the penal sum will be the full amount of the principal's bid, including add
Alternates. Alternatively, if the blank is filled in the amount stated must not be less than the full amount of
the bid including add Alternates, in dollars and cents. A percentage is not acceptable.) For the payment
of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs,
executors, administrators, successors, and assigns.

Signed this _____ day of _____, 20__.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas the above named principal has
submitted a bid for work on the Project.

Now, therefore, if the obligee accepts the bid of the principal and the principal fails to enter into a
proper contract in accordance with the bid, plans, details, specifications, and bills of material; and in the
event the principal pays to the obligee the difference not to exceed ten percent (10%) of the penalty
hereof between the amount specified in the bid and such larger amount for which the obligee may in good
faith contract with the next lowest bidder to perform the work covered by the bid; or in the event the
obligee does not award the contract to the next lowest bidder and resubmits the project for bidding, the
principal pays to the obligee the difference not-to-exceed ten percent (10%) of the penalty hereof
between the amount specified in the bid, or the costs, in connection with the resubmission, of printing new
contract documents, required advertising, and printing and mailing notices to prospective bidders,
whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect; if
the obligee accepts the bid of the principal and the principal within ten (10) days after the awarding of the
contract enters into a proper contract in accordance with the bid, plans, details, specifications, and bills of
material, which said contract is made a part of this bond the same as though set forth herein.

Now also, if the said principal shall well and faithfully do and perform the things agreed by said
principal to be done and performed according to the terms of said contract; and shall pay all lawful claims
of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying
forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall
be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then
this obligation shall be void; otherwise the same shall remain in full force and effect; and surety shall
indemnify the obligee against all damage suffered by failure of the principal to perform the contract
according to its provisions and in accordance with the plans, details, specifications, and bills of material
therefor and to pay all lawful claims of subcontractors, materialmen, and laborers for labor performed or
material furnished in carrying forward, performing, or completing the contract and surety further agrees
and assents that this undertaking is for the benefit of any subcontractor, materialman, or laborer having a
just claim, as well as for the obligee; it being expressly understood and agreed that the liability of the
surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as
herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this _____ day of _____, 20__.

PRINCIPAL

By: _____

Printed Name & Title: _____

SURETY

By: _____

Printed Name & Title: _____

Surety's Address: _____

Surety's Telephone Number: _____

Surety's Fax Number: _____

SURETY'S AGENT

Surety's Agent's Address: _____

Surety's Agent's Telephone Number: _____

Surety's Agent's Fax Number: _____

NOTE: The Contract Bond form that follows is to be used ONLY by a bidder that is awarded a contract and submits a form of bid guaranty other than the combined Bid Guaranty and Contract Bond with its bid. If a bidder submits a combined Bid Guaranty and Contract Bond, then the bid guaranty becomes the contract bond when the contract is awarded.

AIA Bid Bond or Payment and Performance Bond forms are not acceptable for this Project.

CONTRACT BOND

(O.R.C. § 153.57)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned ("Contractor"), as principal, and _____, as surety, are hereby held and firmly bound unto the **Beavercreek Township Board of Trustees** ("Owner") as obligee, in the penal sum of _____ Dollars (\$ _____), for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas, the above-named principal did on the _____ day of _____, 20____, enter into a contract with the Owner for construction of the **Fire Station No. 65 Project** ("Project"), which said contract is made a part of this bond the same as though set forth herein:

Now, if the said Contractor shall well and faithfully do and perform the things agreed by the Contractor to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this _____ day of _____, 20____.

(PRINCIPAL)

(SURETY)

By: _____

By: _____

Printed Name & Title: _____

Printed Name & Title: _____

Surety's Address: _____

Surety's Telephone Number: _____

Surety's Fax Number: _____

NAME OF SURETY'S AGENT

Surety's Agent's Address: _____

Surety's Agent's Telephone Number: _____

Surety's Agent's Fax Number: _____

PRE-BID SUBSTITUTION FORM

Note. Certain brands of material or apparatus are specified. Each bid will be based on these brands, which may be referred to in the Contract Documents as Standards. The use of another brand (referred to as a substitution or proposed equal in the Contract Documents, when a bidder or the contractor seeks to have a different brand of material or apparatus than that specified approved by the Owner for use in the Project) may be requested as provided in the Instructions to Bidders.

The detailed procedures for submitting substitutions are set forth in Paragraph J of the Instructions to Bidders.

[illegible]

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Sales and Use Tax Construction Contract Exemption Certificate

Identification of Contract:

Contractee's (owner's) name Beavercreek Township Board of Trustees

Exact location of job/project 1777 Trebein Road, Beavercreek Township, Ohio 45385

Name of job/project as it appears on contract documentation Fire Station No. 65 Project

The undersigned hereby certifies that the tangible personal property purchased under this exemption certificate was purchased for incorporation into:

☐	A building used exclusively for charitable purposes by a nonprofit organization operated exclusively for charitable purposes as defined in Ohio Revised Code (R.C.) section 5739.02(B)(12);	☒	Real property that is owned, or will be accepted for ownership at the time of completion, by the United States government, its agencies, the state of Ohio or an Ohio political subdivision;
☒	Real property under a construction contract with the United States government, its agencies, the state of Ohio or an Ohio political subdivision;	☐	A computer data center entitled to exemption under R.C. 122.175;
☐	A horticulture structure or livestock structure for a person engaged in the business of horticulture or producing livestock;	☐	A building under a construction contract with an organization exempt from taxation under section 501(c)(3) of the Internal Revenue Code of 1986 when the building is to be used exclusively for the organization's exempt purposes;
☐	A house of public worship or religious education;	☐	A hospital facility entitled to exemption under R.C. section 140.08;
☐	The original construction of a sports facility under R.C. section 307.696;	☐	Building and construction materials and services sold for incorporation into real property comprising a convention center that qualifies for property tax exemption under R.C. 5709.084 (until one calendar year after the construction is completed).
☐	Real property outside this state if such materials and services, when sold to a construction contractor in the state in which the real property is located for incorporation into real property in that state, would be exempt from a tax on sales levied by that state;		

The original of this certificate must be signed by the owner/contractee and/or government official and must be retained by the prime contractor. Copies must be maintained by the owner/contractee and all subcontractors. When copies are issued to suppliers when purchasing materials, each copy must be signed by the contractor or subcontractor making the purchase.

Prime Contractor

Name _____

Signed by _____

Title _____

Street address _____

City, state, ZIP code _____

Date _____

Subcontractor

Name _____

Signed by _____

Title _____

Street address _____

City, state, ZIP code _____

Date _____

Owner/Contractee

Name Beavercreek Township Board of Trustees

Signed by _____

Title _____

Street address 851 Orchard Lane

City, state, ZIP code Beavercreek, Ohio 45434

Date _____

Political Subdivision

Name Same as Owner/Contractee

Signed by _____

Title _____

Street address _____

City, state, ZIP code _____

Date _____

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STATEMENT OF CLAIM FORM

Claim No. ____ for Contractor

1. Name of Contractor: _____

2. Date written claim given: _____.

3. Contractor's representative to contact regarding the claim:

Name: _____ Title: _____

Telephone No. _____ (office) FAX No. _____

E-mail: _____

4. General description of claim:

5. Contract Documents. If the claim is based upon any part or provision in the Contract Documents, including but not limited to pages in the Drawings and/or paragraphs in the Specifications, Owner-Contractor Agreement, General Conditions or Supplementary General Conditions, state upon which parts or provisions the claim is based:

6. Delay claims:

6.1 Date delay commenced: _____

6.2 Duration or expected duration of the delay, if known: _____

6.3 Apparent cause of the delay and part of critical path affected:

6.4 Expected impact of the delay and recommendations for minimizing such impact:

7. Additional compensation. Set forth in detail all additional compensation to which the Contractor believes it is entitled with respect to this claim:

8. Instructions for Completing the Statement of Claim Form ("Instructions"). The Instructions are incorporated in this Form.

9. Truth of Claim. By submitting this claim, the Contractor and its representative certify that after conscientious and thorough review and to the best of his or her knowledge and belief a) the Contractor has complied fully with the Instructions, b) the information in this State of Claim is accurate, c) the Contractor is entitled to recover the compensation in paragraph 7, and d) the Contractor has not knowingly presented a false or fraudulent claim. The Contractor by its authorized representative must acknowledge this Statement of Claim before a notary public.

CONTRACTOR: _____

By: _____

Name and Title: _____

Date: _____

CONTRACTOR'S ACKNOWLEDGMENT

State of _____,

County of _____, ss:

_____ first being sworn, states that after conscientious and thorough review, the statements made in attached Statement of Claim Form are complete and true to the best of his or her knowledge and belief.

Subscribed and sworn to before me on this date by _____ on behalf of _____
_____. The notarial act certified hereby is a jurat. An oath or affirmation was administered to the signer with regard to the notarial act certified to hereby.

Signature of Notary Public

Notary Public: _____

My Commission Expires: _____

WHEN COMPLETED, FORWARD A COPY OF THIS NOTICE AND STATEMENT OF CLAIM FORM TO THE OWNER AND DESIGN PROFESSIONAL.

INSTRUCTIONS FOR COMPLETING THE STATEMENT OF CLAIM FORM

1. Completing the Statement of Claim Form ("Claim Form") is a material term of the Contract. The Claim Form tells the Owner and Design Professional that the Contractor is making a Claim and that they need to act promptly to mitigate the effects of the occurrence giving rise to the Claim. The Claim Form also provides them with information so that they can mitigate such effects. The Contractor acknowledges that constructive knowledge of the conditions giving rise to the Claim through job meetings, correspondence, site observations, etc. is inadequate notice, because knowledge of these conditions does not tell the Owner and Design Professional that the Contractor will be making a Claim and most often is incomplete.
2. If the space provided in the Claim Form is insufficient, the Contractor, as necessary to provide complete and detailed information, must attach pages to the Claim Form with the required information.
3. Paragraph 4. The Contractor must state what it wants, *i.e.*, time and/or compensation, and the reason why it is entitled to time and/or compensation.
4. Paragraph 5. The Contractor must identify the exact provisions of the Contract Documents it is relying on in making its Claim. For example, if the Claim is for a change in the scope of the Contractor's Work, the Contractor must identify the specific provisions of the Specifications, and the Plan sheets and details that provide the basis for the scope change.
5. Paragraph 6. This paragraph applies to delay claims, including delays that the Contractor believes result in constructive acceleration. The Contractor must identify the cause of the delay, party or parties responsible, and what the party did or did not do that caused the delay, *i.e.*, specific work activities. The Contractor acknowledges that general statements are not sufficient, and do not provide the Owner with sufficient information to exercise the remedies available to the Owner or to mitigate the effects of the delay.

For example, if the Contractor claims a slow response time on submittals caused a delay, the Contractor must identify the specific submittals, all relevant dates, and then show on the applicable schedule, by circling or highlighting, the activities immediately affected by the delays. Also for example, if the Contractor claims it was delayed by another Contractor, the Contractor must identify the delaying Contractor, specifically what the delaying Contractor did or did not do that caused the delay, and then show the applicable schedule, by circling or highlighting, the activities immediately affected by the delays. Further by example, if the Contractor seeks an extension of time for unusually severe weather, the Contractor must submit comparative weather data along with a record of the actual weather at the job site and job site conditions.

6. Paragraph 6.4. Time is of the essence under the Contract Documents. If there is a delay, it is important to know what can be done to minimize the impact of the delay. It therefore is important that the Contractor provide specific recommendations on how to do so.
7. Paragraph 7. The Contractor must provide a specific and detailed breakdown of the additional compensation it seeks to recover. For future compensation, the Contractor shall provide its best estimate of such compensation.
8. Paragraph 8 and Acknowledgment. By submitting this Claim, the Contractor and its representative certify that after conscientious and thorough review and to the best of his or her knowledge and belief a) the Contractor has complied fully with the Instructions, b) the information in this Claim Form is accurate, c) the Contractor is entitled to recover the compensation in paragraph 7, and d) the Contractor has not knowingly presented a false or fraudulent claim. The Contractor by its authorized representative must acknowledge this Statement of Claim before a notary public.

End of Instructions

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Project:

Fire Station No. 65 Project

Contract For:

General Contract

Owner:

Beavercreek Township Board of Trustees

CONTRACTOR: [insert name and address]

The Design Professional hereby certifies that the Date for Substantial Completion of the Contractor's Work as set forth in the Owner-Contractor Agreement is:

(Insert Date for Substantial Completion of the Work)

The Design Professional hereby certifies that the Date for Substantial Completion in the Contractor's Agreement with the Owner (the "Agreement"), as extended by Change Orders and Claims submitted by the Contractor that have been Finally Resolved, as defined below, is:

1. Date for Substantial Completion in the Agreement (above):
2. Additional days added to Date for Substantial Completion by Change Order:
3. Additional days added by Claims that have been Finally Resolved:
4. Date for Substantial Completion in the Contract Adjusted by days under No. 2 and No. 3

"Finally Resolved" means that the Design Professional has made a decision (or declined to make a decision) on the Claim under the General Conditions and that any litigation regarding the Claim has been concluded.

The Design Professional certifies that the Contractor's Work to the best of the Design Professional's knowledge, information, and belief was Substantially Complete, as Substantial Completion is defined in the Contract Documents, on .

The Design Professional hereby certifies that the difference between (a) the Date for Substantial Completion adjusted by the days under No. 2 and No. 3 above and (b) the date the Contractor's Work was Substantially Complete is days.

NOTICES OF DELAY. The Design Professional hereby certifies that all "NOTICES OF DELAY" submitted by the Contractor and described in the General Conditions are attached to this Certificate. This certification is solely for the purpose of identifying all "NOTICES OF DELAY" submitted by the Contractor and is not intended to imply that any of these NOTICES OF DELAY were properly submitted in accordance with Contract Documents or are valid.

STATEMENT OF CLAIM FORMS. The Design Professional hereby certifies that all Statement of Claim Forms described in the General Conditions and submitted by the Contractor are attached to this Certificate. This certification is solely for the purpose of identifying all Statement of Claim Forms submitted by the Contractor and is not intended to imply that any of these Statement of Claim Forms were properly submitted in accordance with Contract Documents or are valid.

CERTIFICATE OF SUBSTANTIAL COMPLETION

CSC-1

15236432v1

PUNCHLIST ITEMS. A list of items to be completed by the Contractor is attached to this Certificate. The failure to include items on this list does not change the responsibility of the Contractor to complete its Work in accordance with the Contract Documents. The Contractor shall complete all items on the Punchlist in accordance with the Contract Documents.

Security, maintenance, utilities, damage to the Work and insurance are the responsibility of the Owner and the Contractor based on their operations pursuant to final completion of the Work.

Copies of this Certificate were provided to the Contractor and the Owner on [REDACTED]

Signature: _____

Date: [REDACTED]

PROJECT:
Fire Station No. 65 Project

In Support of PAYMENT APPLICATION No.:

STATE OF _____: _____ SS,
COUNTY OF _____:

[illegible]

Typed or Printed Name of Subcontractor or Supplier	Address of Subcontractor or Supplier	Telephone Number of Subcontractor or Supplier

WITHHOLDINGS FROM SUBCONTRACTORS AND/OR SUPPLIERS:

Typed or Printed Name of Subcontractor or Supplier	Amount Withheld	Reason for Withholding

Moreover, Contractor certifies that, except for as set forth immediately above, Contractor has paid all of its subcontractors and suppliers who were due to be paid with the proceeds of the prior Application for Payment and Contractor acknowledges that Owner is relying upon such certification when paying Contractor the amount asked for in the payment application that this Affidavit and Certification supports.

CONTRACTOR: [insert name]

BY:

(Signature of authorized representative)

NOTARY PUBLIC

Subscribed and sworn to before me on this date by _____ on behalf of _____ . The notarial act certified hereby is a jurat. An oath or affirmation was administered to the signer with regard to the notarial act certified to hereby.

Signature of Notary Public

Notary Public: _____

My Commission Expires: _____

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**CONTRACTOR'S WAIVER & RELEASE AFFIDAVIT
("AFFIDAVIT")**

Project: **Fire Station No. 65 Project**

The undersigned hereby acknowledges receipt of payment for all Work on the Project through the date of the prior Application for Payment by the **Beavercreek Township Board of Trustees** (the "Owner") with which it has a contract for the Project.

In return for said payment, and/or pursuant to certain contractual obligations of the undersigned, the undersigned hereby waives and releases any rights it has or may have through the date of the last Application for Payment to any and all types of claims relating to the Project, including without limitation claims of payment, Mechanic's Lien, stop notice, equitable lien, labor and material bond, breach of contract or unjust enrichment, or any other claim against the Owner, for any labor, materials, or equipment the undersigned may have delivered or provided to the Project, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim form. The undersigned further certifies that this Affidavit covers claims by all contractors, subcontractors, and suppliers who may have provided any labor, material, or equipment to the Project through the undersigned or at the undersigned's request. The undersigned acknowledges that all such contractors, subcontractors, sub-subcontractors and suppliers have signed an affidavit in the form of this Affidavit releasing any and all claims against the Owner, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim form. The undersigned hereby represents and warrants that it has paid any and all welfare, pension, vacation or other contributions required to be paid on account of the employment by the undersigned of any laborers on the Project.

This Affidavit is for the benefit of, and may be relied upon by the Owner. The undersigned hereby agrees to indemnify, defend and hold harmless each of the foregoing, the Project, work of improvement, and real property from any and all claims, or liens that are or should have been released in accordance with this Affidavit.

Company Name

Authorized Signature (Company Officer)

Title

Date

State of: _____ County of _____

Subscribed and sworn to before me this _____
day of _____. The notarial
act certified hereby is a jurat. An oath or affirmation was
administered to the signer with regard to the notarial act
certified to hereby.

Notary Public: _____

My Commission Expires: _____

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**CONTRACTOR'S FINAL WAIVER & RELEASE AFFIDAVIT
("AFFIDAVIT")**

Project: Fire Station No. 65 Project

In consideration for payment received from the **Beavercreek Township Board of Trustees** (the "Owner") in the amount requested in Contractor's Final Application for Payment to the Owner, the receipt of which is hereby acknowledged, the undersigned Contractor hereby waives and releases any rights it has or may have to any and all types of claims relating to the Project, including without limitation claims of payment, Mechanic's Lien, stop notice, equitable lien, labor and material bond, breach of contract or unjust enrichment, or any other claim against the Owner, for any labor, materials, or equipment the undersigned may have delivered or provided to the Project, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim form. The undersigned further certifies that this Affidavit covers claims by all contractors, subcontractors, and suppliers who may have provided any labor, material, or equipment to the Project through the undersigned or at the undersigned's request. The undersigned acknowledges that all such contractors, subcontractors, sub-subcontractors and suppliers have signed an affidavit in the form of this Affidavit releasing any and all claims against the Owner, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim form. The undersigned hereby represents and warrants that it has paid any and all welfare, pension, vacation or other contributions required to be paid on account of the employment by the undersigned of any laborers on the Project.

This Affidavit is for the benefit of, and may be relied upon by the Owner. The undersigned hereby agrees to indemnify, defend and hold harmless each of the foregoing, the Project, work of improvement, and real property from any and all claims, or liens that are or should have been released in accordance with this Affidavit.

Company Name

Authorized Signature (Company Officer)

Title

Date

State of: _____ County of _____

Subscribed and sworn to before me this _____
day of _____. The notarial
act certified hereby is a jurat. An oath or affirmation was
administered to the signer with regard to the notarial act
certified to hereby.

Notary Public: _____

My Commission Expires: _____

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**SUBCONTRACTORS, SUPPLIERS
FINAL WAIVER & RELEASE AFFIDAVIT
("AFFIDAVIT")**

Project: **Fire Station No. 65 Project**

Upon receipt of payment in the amount of \$_____ received from _____ ("Prime Contractor") the undersigned Subcontractor or Supplier waives and relinquishes all rights of lien or claim that it may have either in law or equity (including but not limited to rights under Ohio Mechanics' Lien Laws, O.R.C. 1311.01 *et seq.*) with respect to the construction project known as _____ ("the Project"), for all labor, all equipment, and/or materials provided to or on behalf of the Project throughout its entirety, except for claims previously made pursuant to the agreement in place between Subcontractor or Supplier and Prime Contractor, and any lien previously perfected and remaining unreleased.

The undersigned Subcontractor or Supplier acknowledges and agrees that such payment represents final payment in full for all such labor, equipment and/or materials including retainage, if any, and that the Subcontractor or Supplier has completed its work on the Project. The undersigned Subcontractor or Supplier certifies that all amounts have been paid by the Subcontractor or Supplier for all work or materials furnished by others to the Subcontractor or Supplier for which the Subcontractor or Supplier has received previous payments from Prime Contractor, and Subcontractor or Supplier acknowledges that Prime Contractor is now making payment to the Subcontractor or Supplier in reliance upon such certification. The undersigned Subcontractor or Supplier further certifies that it will pay all amounts lawfully owing for all work or materials furnished by others to the Subcontractor or Supplier with the payment received from Contractor referenced herein.

This Affidavit is for the benefit of, and may be relied upon by, the Contractor, the Contractor's surety and the Owner. The undersigned hereby agrees to indemnify, defend and hold harmless each of the foregoing, the Project, its Work, and real property from any and all claims, or liens that are or should have been released in accordance with this Affidavit and from any liability, cost, or expense incurred as a result of any breach of this Affidavit by the undersigned.

IN WITNESS WHEREOF, the undersigned has caused this Affidavit to be executed by its authorized representative as of the date indicated below.

THE INDIVIDUAL SIGNING THIS AFFIDAVIT REPRESENTS THAT HE/SHE IS AUTHORIZED TO DO SO.

SUBCONTRACTOR OR SUPPLIER:

Company Name

Authorized Signature (Company Officer)

Title

Date

State of: _____ County of _____

Subscribed and sworn to before me this _____
day of _____. The notarial
act certified hereby is a jurat. An oath or affirmation was
administered to the signer with regard to the notarial act
certified to hereby.

Notary Public: _____

My Commission Expires: _____

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Prevailing Wage Rates-Greene : Greene County

Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Insulators	Local 207 - Ohio	Asbestos Abatement	\$25.50	\$14.42	\$39.92	8/23/2018
Insulators	Asbestos Local 50 Zone 2	Asbestos Insulation f	\$31.09	\$18.14	\$49.23	7/9/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Boilermakers	Boilermaker Local 105	Boilermaker	\$35.26	\$24.79	\$60.05	9/25/2013
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Bricklayer	Bricklayer Local 22	Bricklayer Stone Mas	\$27.01	\$14.82	\$41.83	6/1/2019
Bricklayer	Bricklayer Local 22 Tile Finishe	Bricklayer Tile Marbl	\$24.47	\$9.16	\$33.63	7/1/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Cement Mason	Cement Mason Local 132 (Dayt	Cement Mason	\$23.93	\$17.10	\$41.03	6/5/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Electrical	Electrical Local 82 Inside	Electrician	\$31.15	\$19.96	\$51.11	12/18/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Elevator	Elevator Local 11	Elevator Mechanic	\$47.23	\$40.06	\$87.29	1/1/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Glazier	Glazier Local 387	Glazier	\$27.03	\$15.67	\$42.70	11/6/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Ironworker	Ironworker Local 290	Ironworker Structural	\$29.23	\$22.37	\$51.60	6/1/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Laborer	Labor Local 1410 Building	Laborer Group 1	\$25.90	\$11.20	\$37.10	7/3/2019
Laborer	Labor HevHwy 3	Laborer Group 1	\$32.62	\$11.35	\$43.97	5/14/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Painter	Painter Local 249	Painter Brush Roll	\$23.67	\$11.50	\$35.17	5/1/2019
Painter	Painter Local 249 HevHwy	Painter Bridge Class	\$35.38	\$11.50	\$46.88	5/1/2019
Painter	Painter Local 249	Wall Covering Vinyl &	\$23.67	\$11.50	\$35.17	5/1/2019
Painter	Painter Local 249	Spray Commercial	\$23.67	\$11.50	\$35.17	5/1/2019
Painter	Painter Local 249	Spray Industrial	\$23.67	\$11.50	\$35.17	5/1/2019
Painter	Painter Local 249	Sandblasting, Steam	\$24.42	\$11.50	\$35.92	5/1/2019
Painter	Painter Local 249	Special Coating (Coa	\$25.17	\$11.50	\$36.67	5/1/2019
Painter	Painter Local 249	Steeplejack Work	\$24.62	\$11.50	\$36.12	5/1/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Plasterer	Plasterer Local 132 (Dayton)	Plasterer	\$23.25	\$17.45	\$40.70	6/5/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Sheet Metal	Sheet Metal Local 24 (Dayton)	Sheet Metal Worker	\$27.72	\$23.83	\$51.55	6/19/2019
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Roofer	Roofer Local 75	Roofer	\$24.38	\$18.72	\$43.10	6/4/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Plumber/Pipefitter	Plumber Pipefitter Local 162	Plumber Pipefitter	\$32.25	\$25.99	\$58.24	6/18/2020
Craft	Local	Classification	Wage	Fringe*	Total Package	Last Updated
Sprinkler Fitter	Sprinkler Fitter Local 669	Sprinkler Fitter	\$40.40	\$22.77	\$63.17	4/8/2020

*Fringe includes the following benefits: Health & Welfare, Pension, Apprenticeship Training, Vacation, Annuity, and other.

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SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Owner-furnished products.
 - 4. Contractor-furnished, Owner-installed products.
 - 5. Access to site.
 - 6. Specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Beaver Creek Township Fire Station No. 65, Project Number 3541.01.
 - 1. Project Location: 1777 Trebein Road, Beaver Creek Township, Ohio 45385.
- B. Owner: Beaver Creek Township Fire Department, 851 A Orchard Lane, Beaver Creek, Ohio 45434.
 - 1. Owner's Representative: Nathan Hiester, Battalion Chief, Beaver Creek Township Fire Department, 851 A Orchard Lane, Beaver Creek, Ohio 45434.
- C. Architect: Timothy J. Bement, AIA, App Architecture, 615 Woodside Drive, Englewood, Ohio 45322.
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Civil Engineer: Choice One Engineering, 440 East Hoewisher Road, Sidney, Ohio 45365.
2. Structural Engineer: Jezerinac Geers & Associates, Inc., 5640 Frantz Road, Dublin, Ohio 43017.
3. Plumbing, Mechanical, Electrical Engineer: Nauman & Zelinski LLC, 204 S. Ludlow Street, Suite 400, Dayton, Ohio 45402.
4. Landscape Architect: Yellow Springs Design, 830 Xenia Avenue, Yellow Springs, Ohio 45387.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work is defined by the Contract Documents and consists of the following:
 1. Design and construction of a new Fire Station.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
 1. Refer to the matrices located in drawings.

1.6 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. 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: Limit site disturbance, including earthwork and clearing of vegetation, to 10 feet beyond all property lines.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

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SECTION 01 2100 - ALLOWANCES

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 governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Winter protection.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Winter protection to cover concrete slab with insulating blankets and temporary heat and tenting for masonry work.

END OF SECTION 01 2100

SECTION 01 2200 - UNIT PRICES

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 for unit prices.
- B. Related Requirements:
 - 1. Section 01 4000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
 - 1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 31 2000 "Earth Moving."
- B. Unit Price No. 2: Rock excavation and replacement with satisfactory soil material.
 - 1. Description: Classified rock excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 31 2000 "Earth Moving."
- C. Unit Price No. 3: Removal of unsatisfactory soil and replacement with low-strength concrete (lsm or clsm).
 - 1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with low-strength concrete from off-site, as required, according to Section 31 2000 "Earth Moving" and the Geotechnical Reports included with the Bidding Documents.
- D. Unit Price No. 4: Provide and place lime for the purpose of drying wet soils.
- E. Unit Price No. 5: Provide and place 304 gravel.

END OF SECTION 01 2200

SECTION 01 2300 - ALTERNATES

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 for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate G-1:

Provide all labor and materials to provide a standing seam metal roof and snow guards in lieu of asphalt shingles.

Alternate C-1:

Provide all labor and material to construct the site without the bypass driveway and include all necessary grass seeding of the area.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION 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 for substitutions.
- B. Related Requirements:
 - 1. Section 01 6000 "Product Requirements" for requirements to submit comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 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.
- B.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination 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 substitution 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 and 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 substitution 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.
2. 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.

1.5 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.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

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. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. 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. Requests received after that time may be considered or rejected at discretion of Architect.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied,

Architect will return requests without action, except to record noncompliance with these requirements:

- 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. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. 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)

SUBSTITUTION REQUEST FORM

615 Woodside Drive, Englewood, Ohio 45322

T 937.836.8898 F 937.832.3696

www.app-arch.com

DATE:

TIME:

PROJECT: Beaver Creek Township
FIRE STATION No. 65

PROPOSED SUBSTITUTION: _____

REQUEST AUTHOR: _____ **REQUIRED REPLY DATE:** _____

REPLY: _____

REPLY AUTHOR: _____ **REPLY DATE:** _____

ATTACHMENTS:

ACTION REQUIRED:

DISTRIBUTION:

END OF SECTION 01 2500

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SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

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 provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 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 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.
 - 4. Section 01 9100 "Commissioning" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 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, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

B. Key Personnel Names: Within 7 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 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 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.

- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

- c. Fire-rated enclosures around ductwork.
2. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
3. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
4. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
5. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 3300 "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 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.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat 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 approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. 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 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 the General Conditions of the Contract.
 - 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 bi-weekly. Software log with not less than 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. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 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.
 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 3 days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, 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.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Designation of key personnel and their duties.
 - c. Lines of communications.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for RFIs.
 - f. Procedures for testing and inspecting.

- g. Submittal procedures.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - 4. 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 that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority 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. Deliveries.
 - b. Review of mockups.
 - c. Possible conflicts.
 - d. Compatibility requirements.
 - e. Time schedules.
 - 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 45 days prior to the scheduled date of Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

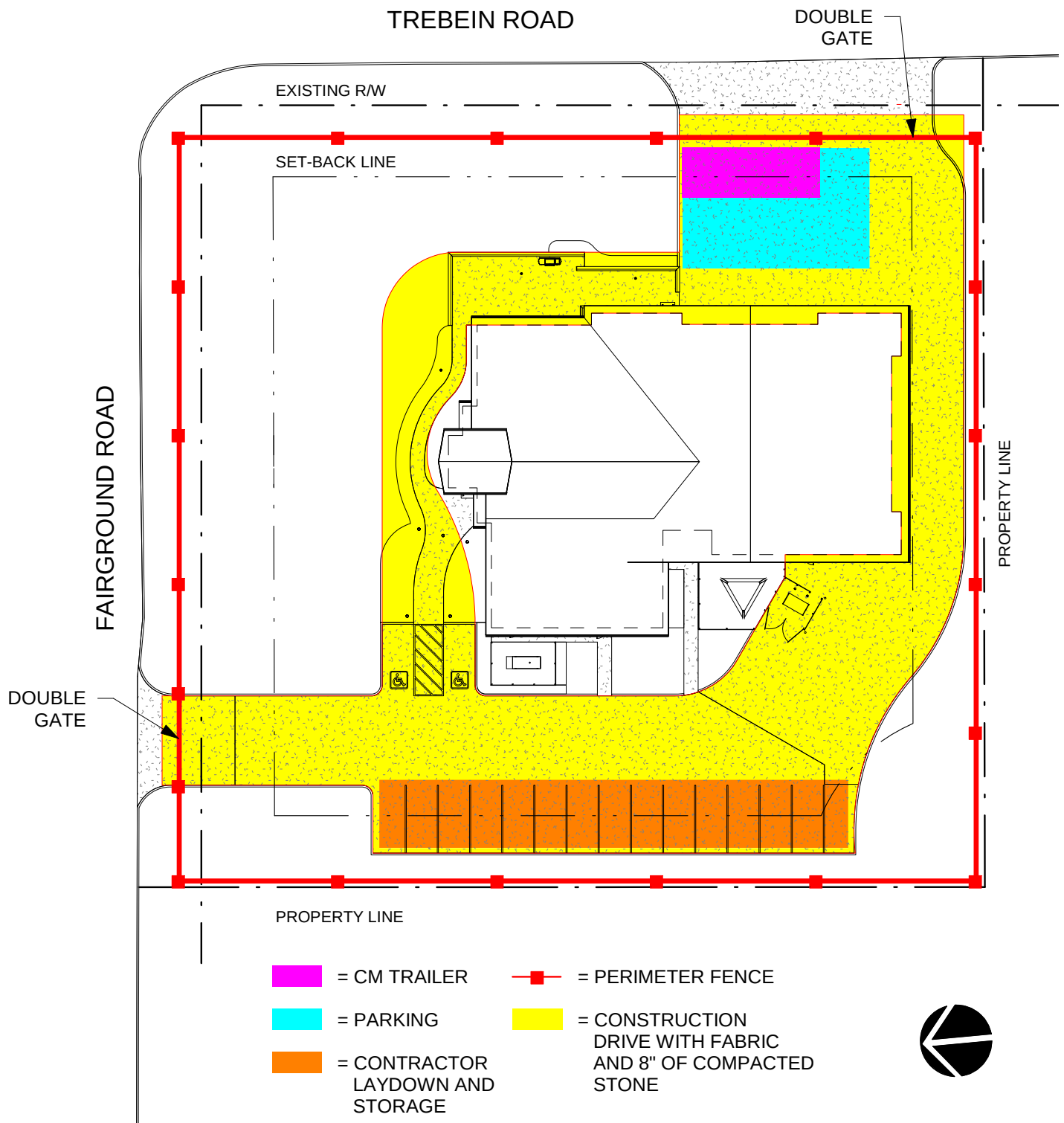
- c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority 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) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.

- 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
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)

SUGGESTED LAYOUT



SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

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 for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Daily construction reports.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

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 electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. Daily Construction Reports: Submit at weekly intervals.

1.4 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final 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 story 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 30 days, unless specifically allowed by Architect.
 - 2. Startup and Testing Time: Include no fewer than 14 days for startup and testing.
 - 3. 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.
 - 4. 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
- D. 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. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Testing and commissioning.
 - d. Punch list and final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

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. Approximate count of personnel at Project site.
 - 3. Equipment at Project site.
 - 4. Material deliveries.
 - 5. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 6. Accidents.
 - 7. Meetings and significant decisions.
 - 8. Stoppages, delays, shortages, and losses.
- 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.

2.4 SPECIAL REPORTS

- A. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

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 and 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 01 3200

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SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by the Architect for Contractor's use in preparing submittals. Submit a copy of the agreement bound into these specifications along with specified payment.
- 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. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: The General Contractor is responsible for preparing a list of submittals to be submitted during the course of the project. The Submittal Schedule must be submitted electronically to the Architect prior to submitting any information.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 business 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 working 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.
- E. Identification: Place a submittal cover sheet on each submittal copy for identification (including material sample submittals).
1. Submittal number shall be a sequential number (e.g., 01, 02, 03, etc.). Resubmittals shall include the letter "R" after the submittal number (e.g., 01R, 02R, etc.).
- F. Deviations: Highlight, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. 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. A hard copy of all submittals and material samples must be kept at the jobsite in the construction trailer for reference by the Contractor and/or Architect.
- H. Use for Construction: Use only final submittals with mark indicating "reviewed" or "reviewed as noted," taken by Architect or Engineer.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable 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 written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.

- d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shop work manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, create Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
- D. Electronic Submittal Guidelines:
- 1. INFORMATION SUBMITTALS:

Use Submittal Exchange. A submittal cover sheet (found at the end of this section) must be used as the cover sheet of each submittal copy.

The actual PDF file name should be the section number and name:

Example: "08 7100 Door Hardware.PDF"

If the file being submitted is a resubmittal, the file name should be:

Example: "08 7100 Door HardwareR1.PDF"

PDF files are to be created in the same sheet size as the original documents to preserve the drawing scale.

In order to keep files sizes manageable, only pertinent product information should be submitted. Avoid sending entire product catalogs when only a small portion of the information is pertinent to the project. Submittals containing excessive non-pertinent information will be rejected. Proposed model numbers/products must be identified; otherwise, the submittal will be rejected.

SAMPLES:

Product samples and color selection charts must have a Submittal Cover Sheet attached to them. If samples are associated with an electronically submitted information submittal, reference the electronic submittal number followed by the letter "S" on the Sample Submittal Cover Sheet.

Submit (2) copies of each color selection chart and (2) copies of product samples.

- a. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Prior to submitting to Architect, General Contractor shall Review each submittal and check for compliance with Contract Documents. Check for coordination with other Work of the Contract and note corrections and field dimensions. Mark with approval stamp before submitting to Architect. Architect will reject any submittal determined to be incomplete.
- B. Approval Stamp: Stamp each Submittal Cover Sheet with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ARCHITECT'S ACTION

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

- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. "Reviewed"
 - 2. "Reviewed as noted"
 - 3. "Revise & resubmit"
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

Project Submittal Cover Sheet

Date: _____

Submittal Number _____

Submittal Name: _____

Spec Section No: _____

Project: BEAVERCREEK TOWNSHIP FIRE DEPARTMENT
FIRE STATION NO. 65

General Contractor: _____

PH. _____ FAX: _____

Subcontractor: _____ Supplier Name: _____

Architect: App Architecture
615 Woodside Drive
Englewood, OH 45322

General Contractor's Approval Stamp

Architect's/Engineer's Action Stamp

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

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 for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless

otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- F. 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, 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).
- G. Experienced: When used with an entity or individual, "experienced" 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.

1.4 CONFLICTING REQUIREMENTS

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

1.5 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.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Manufacturer's Technical 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.
- F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.

1.6 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 inspecting 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, and the Contract Sum will be adjusted by Change Order.

- B. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7 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:

- B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Refer to the structural drawings for a complete list of required Special Inspections.

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.
5. Submittal Exchange.

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "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.

Agreement & Waiver For Use of Architectural Computer Aided Design Files



615 Woodside Drive, Englewood, Ohio 45322

T 937.836.8898 F 937.832.3696

www.app-arch.com

PROJECT: _____

OWNER: _____

CLIENT: _____

The undersigned acknowledges the receipt of electronic CAD files in _____ format for the above referenced project. These files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of this project only. These files and the information contained within are part of the architect's instruments of service and remain the property of App Architecture. The electronic files shall not be reproduced or used in any form except in conjunction with this project.

The User acknowledges that the information provided in these files is not a substitute or replacement for the Contract Documents. The User acknowledges that neither App Architecture, the Consultants, the Client nor the Owner make any warranty or representation that the information contained in these files reflects the hard-copy Contract Documents in their entirety. The User assumes full responsibility in the use of these files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

The User acknowledges that the furnishing of these files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as required by the Contract between the Contractor and the Owner including the need to check, confirm and coordinate the work with that of other contractors for this project.

The User agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against App Architecture, the Consultants, the Client, the Owner and any of their agents that may arise out of or in connection with the use of these electronic files.

Furthermore, the User shall, to the fullest extent permitted by law, indemnify and hold harmless against App Architecture, the Consultants, the Client, the Owner and any of their agents against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

Under no circumstances shall the delivery of these electronic files be deemed a sale by App Architecture, and no warranties, either express or implied, of merchantability and fitness for any particular purpose is made. In no event shall App Architecture be liable for any loss of profit or any consequential damages as a result of the use or reuse of these electronic files.

LIST OF DRAWING FILES REQUESTED: _____

The following costs are applicable to delivery of these files on CD-ROM or by e-mail:

COST OF PREPARATION OF CAD FILES: First drawing file: \$50.00
Additional drawing files: \$15.00/each

USER (FIRM NAME): _____ **DATE:** _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

PHONE NO.: _____

SIGNED: _____ **TITLE:** _____

NAME (PRINTED): _____

App Architecture
615 Woodside Drive
Englewood, OH 45322
937.836.8898

Agreement & Waiver For Use of Engineering Computer Aided Design Files

Nauman & Zelinski LLC

204 South Ludlow Street, Suite 400

Dayton, Ohio 45402

P: 937.223-3821

F: 937.223-3849

PROJECT: _____

OWNER: _____

CLIENT: _____

The undersigned acknowledges the receipt of electronic CAD files in _____ format for the above referenced project. These files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of this project only. These files and the information contained within are part of the architect's instruments of service and remain the property of App Architecture. The electronic files shall not be reproduced or used in any form except in conjunction with this project.

The User acknowledges that the information provided in these files is not a substitute or replacement for the Contract Documents. The User acknowledges that neither Nauman & Zelinski, the Consultants, the Client nor the Owner make any warranty or representation that the information contained in these files reflects the hard-copy Contract Documents in their entirety. The User assumes full responsibility in the use of these files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

The User acknowledges that the furnishing of these files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as required by the Contract between the Contractor and the Owner including the need to check, confirm and coordinate the work with that of other contractors for this project.

The User agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Nauman & Zelinski, the Consultants, the Client, the Owner and any of their agents that may arise out of or in connection with the use of these electronic files.

Furthermore, the User shall, to the fullest extent permitted by law, indemnify and hold harmless against Nauman & Zelinski, the Consultants, the Client, the Owner and any of their agents against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

Under no circumstances shall the delivery of these electronic files be deemed a sale by Nauman & Zelinski, and no warranties, either express or implied, of merchantability and fitness for any particular purpose is made. In no event shall App Architecture be liable for any loss of profit or any consequential damages as a result of the use or reuse of these electronic files.

LIST OF DRAWING FILES REQUESTED: _____

The following costs are applicable to delivery of these files on CD-ROM or by e-mail:

COST OF PREPARATION OF CAD FILES: None

USER (FIRM NAME): _____ **DATE:** _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

PHONE NO.: _____

SIGNED: _____ **TITLE:** _____

NAME (PRINTED): _____

Nauman & Zelinski
204 South Ludlow Street, Suite 400
Dayton, OH 45402
937.223.3821

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SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 32 1313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- C. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 - 3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 7700 "Closeout Procedures."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 1. Locate facilities to limit site disturbance as specified in Section 01 1000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

- C. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service underground unless otherwise indicated.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- D. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- E. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
 - 1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
 - 2. Memory: 4 gigabyte.
 - 3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
 - 4. Display: 60-inch LCD monitor with 256-Mb dedicated video RAM.
 - 5. Full-size keyboard and mouse.
 - 6. Network Connectivity: 02/110 BaseT Ethernet.
 - 7. Operating System: Microsoft Windows XP Professional or Microsoft Windows Vista Business.
 - 8. Productivity Software:
 - a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader 7.0 or higher.

c. Monitor Submittal Exchange.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 3 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads: Construct and maintain temporary roads adequate for construction operations. Locate temporary roads within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 2000 "Earth Moving."
3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 1216 "Asphalt Paving."

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.

3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

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SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Sections:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 31 1000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by the average of the smallest and largest diameters at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
- B. Topsoil: Imported or manufactured topsoil complying with ASTM D 5268.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements.
 1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.
 - a. Height: 4 feet (1.2 m).
 - b. Color: High-visibility orange, nonfading.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch (25-mm) blue-vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
- B. Maintain protection zones free of weeds and trash.
- C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.7 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.
 - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during

construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
2. Plant and maintain new trees as specified in Section 32 9300 "Trees, Plants and Ground Cover."

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 5639

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SECTION 01 6000 - PRODUCT REQUIREMENTS

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 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 01 2500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify 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: As specified in Section 01 3300 "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 01 3300 "Submittal Procedures." Show compliance with requirements.

1.5 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.

1.6 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. 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.
 - 2. 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.
 - 3. 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 that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
2. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
3. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
4. Protect stored products from damage and liquids from freezing.

1.7 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. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 7700 "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. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- 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.
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. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

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 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. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for limits on use of Project site.
 - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 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. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- 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 Owner 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 01 3100 "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.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. 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.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. 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.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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: Do not use tools or equipment that produce harmful 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 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 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

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.
 - a. Use containers intended for holding waste materials of type to be stored.
- 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. Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9100 "Commissioning."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "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 01 7300

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SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.
- B. Related Requirements:
 - 1. Section 04 2200 "Concrete Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 31 1000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.2 DISPOSAL OF WASTE

- A. General: 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.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 7419

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SECTION 01 7700 - CLOSEOUT 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 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.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 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.

1.7 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 the General Conditions of the Contract.
 - 2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 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. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Contractor.
 - d. Page number.
 - 3. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

- B. Partial Occupancy: Submit properly executed warranties within 15 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.
 - 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 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.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. 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.

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. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. 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.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Sweep concrete floors broom clean in unoccupied spaces.
 - g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - h. 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.
 - i. Remove labels that are not permanent.
 - j. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - m. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - o. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

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 01 7700

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SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

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 for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Product maintenance manuals.
 - 4. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

Definition in "System" Paragraph below is from ASHRAE's "Technology Handbook."

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operations 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.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer Comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final 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 and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- 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. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to

ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: 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.
- B. 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. Cross-reference to related systems in other operation and maintenance manuals.
- C. 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.
- D. 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.
- E. 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.

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 PRODUCT MAINTENANCE MANUALS

- A. 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.
- B. 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.
- 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.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.5 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 and drawing or schedule designation or identifier where applicable.

- 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.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- 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.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- 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. 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.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- C. 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.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- D. 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.
 - 2. Comply with requirements of newly prepared record Drawings in Section 01 7839 "Project Record Documents."
- E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

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SECTION 01 7839 - PROJECT RECORD DOCUMENTS

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 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 01 7700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 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 annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

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. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Duct size and routing.
 - h. Locations of concealed internal utilities.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. 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 and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. 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.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
- B. Format: Submit record Product Data as annotated PDF electronic file.
 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

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.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

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 for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Requirements:
 - 1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 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.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 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 instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. 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.
- D. 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.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 7900

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 31 2000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 32 1313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting

procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: On request only, for Installer, manufacturer, and/or testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Curing compounds.
 - 5. Floor and slab treatments.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Vapor retarders.
 - 9. Semirigid joint filler.
 - 10. Joint-filler strips.
 - 11. Repair materials.
 - 12. Synthetic reinforcement
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.

- F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Reference standards:
 - 1. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 2. ACI 315R, Details and Detailing of Concrete Reinforcement.
 - 3. ACI 347R, Guide to Formwork for Concrete.
 - 4. ACI 302.1R, Guide for Concrete Floor and Slab Construction.
 - 5. "Placing Reinforcing Bars", CRSI & WCRSI Recommended Practice.
 - 6. ACI 301, Specifications for Structural Concrete.
 - 7. ACI 117, Specifications for Tolerances for Concrete Construction and Materials.
- E. Mockups of Polished Concrete Floors: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Prior to the installation of polished and stained concrete work construct a maximum of two mockups of polished and stained concrete for the Architect to review. The mock-up will be at the project site at a location mutually agreed to by the Architect and Contractor.
 - 2. Construct the one mock-up installation of polished and stained concrete a minimum 64 square foot area of concrete units showing color and finish selected as shown on the Drawings.
 - 3. Final color selection will be made from the mock-up.

- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 FIELD REFERENCE MANUALS

- A. Provide at least one copy of the ACI Field Reference Manual, SP-15 (1.3.3), and one copy of CRSI's "Placing Reinforcing Bars" in the field office at all times.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301 (ACI 301M).
 - 2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, Grade 60 (Grade 420), deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 706/A 706M, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), or deformed bars, assembled with clips.
- E. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C, may be used up to a maximum of 25% of the total cementitious content.

- b. Ground Granulated Blast-Furnace Slag GGBF Slag: ASTM C 989/C 989M, Grade 100 or 120, may be used up to a maximum of 30% of the total cementitious content.
 - c. For polished concrete: Fly Ash and or GGBF Slag may be used up to a maximum of 15% of the total cementitious content.
 - d. The exact percentages used shall be based on a successful test placement on-site.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Use size no. 8 for coarse aggregate in topping on stair pans.
 - 2. For all other locations, use size no. 57.
 - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.6 GROUT MATERIALS

- A. Grout for masonry core fill: ASTM C476, coarse type.
- B. Non Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Package Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate. The following are acceptable:
 - 1. N S Grout by The Euclid Chemical Co.
 - 2. Masterflow 713 by BASF The Chemical Co.
 - 3. Five Star Grout by U.S. Grout Corp.

- C. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107 "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink)." IN addition, the grout manufacturer shall furnish test data from an independent laboratory indicating the grout when placed at a fluid consistency shall achieve a 95% bearing under a 18" x 36" base plate. The following are acceptable:
 - 1. Hi-Flow Grout by The Euclid Chemical Co.
 - 2. Masterflow 928 by BASF The Chemical Co.
- D. All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified non shrink grout, with minimum 28-day strength of 9,000 psi.
- E. Water: Potable.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mil (minimum). Permeance of .01 maximum per ASTM E 154, Sections 8, 11, 12, and 13. Tensile Strength not less than 45 lbf/in. Puncture resistance: 2200 grams. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - c. Meadows, W. R., Inc.; Perminator.
 - d. Flatiron Films; Iron Bar 15.
 - e. Stego Industries, LLC; Stego Wrap.
 - f. Raven Industries; Vaporblock VB15.

2.8 GRANULAR FILL

- A. Granular Fill (Stone Subbase): Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, size 57, with 100 percent passing a 1½" (37.5 mm) sieve and 0 to 5 percent passing a #8 sieve.

2.9 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

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. Conspec by Dayton Superior; Intraseal.
 - b. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - c. Edoco by Dayton Superior; Titan Hard.
 - d. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - e. Meadows, W. R., Inc.; LIQUI-HARD.

2.10 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 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. Conspec by Dayton Superior; Aquafilm.
 - b. Dayton Superior Corporation; Sure Film (J-74).
 - c. Edoco by Dayton Superior; BurkeFilm.
 - d. Euclid Chemical Company (The), an RPM company; Eucobar.
 - e. Meadows, W. R., Inc.; EVAPRE.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Curing and Sealing Compound (VOC Compliant, 700g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class B, 25% solids content minimum. Moisture loss shall be not more than 0.30 Kg/m² when applied at 300 sq. ft./gal. Manufacturers certification is required. Subject to project requirements, provide one of the following products:
 1. Super rez Seal by The Euclid Chemical Co.
 2. Materseal 30 by BASF The Chemical Co.
 3. Kure N Seal 30 by Sonneborn
- F. Curing and Sealing Compound (VOC Compliant, 350g/l): Liquid type membrane-forming curing compound, clear styrene acrylate type, complying with ASTM C1315, Type I, Class A, 25% solids content minimum. Moisture loss shall be not more than 0.40 Kg/m² when applied at 300 sq. ft./gal. Manufacturers certification is required. Subject to project requirements, provide one of the following products:

1. Super Diamond Clear VOX by The Euclid Chemical Co.
2. Super Rrez SealVOX by The Euclid Chemical Co.
3. Masterkure 100W by BASF The Chemical Co.

G. Curing Compound (Strippable): The compound shall conform to ASTM C309 and is to be used on slabs that are to receive subsequent applied finishes and where noted on the drawings. Install in strict accordance with the manufacturer's recommendations and supervision. Verify compound is compatible with the applied finish prior to placement, subject to approval the following are acceptable:

1. Kurez DR VOX by The Euclid Chemical Co.
2. Kurez W VOX by The Euclid Chemical Co.

H. At polished concrete areas: See architectural plan for locations.

1. Slab shall only be wet cured (minimum of 8 days). No membrane forming curing compound shall be applied in these areas.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

C. Polyurea Joint Filler (at polished concrete floors).

1. Versaflex: www.versaflex.com

D. Bonding and Repair Materials:

1. Structural Bonding Compound: Epoxy adhesive, 100% solids, two-component material suitable for use on dry or damp surface. The following are acceptable:

- a. Euco Epoxy #352 or #452 Series by The Euclid Chemical Co.
- b. Sikadur Hi Mod by Sika Chemical Co.
- c. Epoxitite 2390 by A. C. Horn, Inc.

2. Patching Compound, Epoxy Type: 100% solids suitable for use on dry or damp surface. The following are acceptable:

- a. Euco Epoxy #456 mortar by The Euclid Chemical Co.
- b. Sikadur Lo Mod Mortar by Sika Chemical Co.
- c. Epoxitite 2390 Mortar by A. C. Horn, Inc.

3. Polymer Patching Mortar: The following are acceptable:

- a. Horizontal applications:
 - 1) Top Thin Supreme by The Euclid Chemical Co.
 - 2) Concrete Top Supreme by The Euclid Chemical Co.
 - 3) Patchwell by Kaufman Company
 - 4) Sikatop 122 by Sika Chemical Co.
- b. Vertical applications:
 - 1) Verticoat by The Euclid Chemical Co.
 - 2) Verticoat Supreme by The Euclid Chemical Co.
 - 3) Sikatop 123 by Sika Chemical Co.
4. Underlayment compound: Free-flowing, self-leveling, pumpable cementitious base compound. Compound shall have a compressive strength conforming to ASTM C109 of 3,600 psi at 7 days and 5,000 psi at 28 days and a bond strength conforming to ASTM C1042 of 700 psi at 7 days and 1,000 psi at 28 days. The following are acceptable:
 - a. Flo-Top by The Euclid Chemical Co.
5. Repair Topping: Self-leveling, polymer modified high strength topping. The following are acceptable:
 - a. Thin-Top Supreme by The Euclid Chemical Co.
6. Bonding Compound: Polyvinyl acetate, rewettable type. Use only in areas not subject to moisture. The following are acceptable:
 - a. Euco Weld by The Euclid Chemical Co.
 - b. Weldcrete by Larson Products
 - c. Daraweld C by W.R. Grace Co.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 CONCRETE MIXTURES

- A. The following classes of concrete are required:

Type	F'c at 28 days	Maximum Water Cementitious Ratio	Air Content
Lean concrete fill	1,500 PSI	--	optional

Footings, grade beams, and all other below grade concrete	3,500 PSI	0.55	optional
Exterior foundation stem walls, exterior foundation walls, exterior column piers	4,500 PSI	0.45	5-7%
Interior slabs on grade	3,500 PSI	0.50	optional
Interior slabs on grade (to receive polished concrete finish)	3,500 PSI	0.45	none
Structural concrete slabs, beams, and columns	5,000 PSI	0.42	optional
Interior slabs on metal deck	3,500 PSI	0.45	optional
Stair pan fill	3,500 PSI	0.45	optional
Unreinforced exterior slabs on grade, or site concrete	4,500 PSI	0.45	5-7%
Reinforced exterior site concrete	5,000 PSI	0.40	5-7%

1. Slump: All concrete containing the high-range water-reducing admixture (superplasticizer) shall have a maximum slump of 8 inches unless approved by the Architect. The concrete shall arrive at the job site at a slump of 2 to 3 inches, to be verified, then the high-range water-reducing admixture added to increase the slump to the approved level. All other concrete shall have a maximum slump of 5 inches for all members, unless otherwise noted. For the high-range water-reducing admixture added at the batch plant, verification is to be provided that the water-to-cement ratio has not been exceeded.
2. Use no. 8 coarse aggregate for metal stair pan fill, Class V.
3. Supplementary cementitious materials, fly ash and GGBF slab, are permitted in all classes.
4. Class VI concrete may be site mixed; all other concrete is to be ready-mixed.
5. All admixtures, except superplasticizer, are to be added at the batch plant. Superplasticizer may be added at the jobsite through an approved dispenser.
6. Mixes intended to be pumped are to be so identified on the mix design submitted for approval. All pumped mixes are to have a mid-range or high-range water-reducer. Maximum slump at the pump shall be 7" for concrete containing the mid-range water-reducing admixture and 9" for concrete containing the high-range water-reducing admixture.
7. All concrete for Classes II, III, and IV shall contain the specified water-reducing or

water-reducing/retarding admixture, mid-range water-reducing admixture and/or high-range water-reducing admixture (superplasticizer). All concrete slabs, placed at air temperature below 50 degrees F shall contain the specified non-corrosive, non-chloride accelerator. All concrete placed at air temperature above 90 degrees shall contain the specified water-reducing/retarding admixture. All concrete required to be air-entrained shall contain an approved air-entraining admixture. All pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, and concrete with a water-cementitious ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer). Concrete with a water-cementitious ratio above 0.45 may contain the specified mid-range water-reducing admixture.

8. For slabs on metal deck, add Euclid Chemical Company TUF-Strand SF polypropylene macro synthetic reinforcing fiber at a dosage rate of 3lbs/cubic yard.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete where indicated.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. Remove no forms within first 24 hours after placement.
- B. When structure is to be reshored, forms may be removed when the concrete attains 75% of its design strength.
- C. Shoring is to remain in place until concrete reaches its design strength. Windsor Pentrometer is to be used to verify in place strength if forms are removed prior to 7 days after casting concrete.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- D. When the average daily temperature has been below 50 degrees F for the duration of the curing period, forms may not be removed until the actual in place strength of the concrete is demonstrated by two field cured test cylinders or by Windsor Pentrometer, regardless of the results of tests on laboratory cured cylinders.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Interior Slabs-on-Grade:
 - 1. Locate control (contraction) joints as shown on the Drawings. In the absence of information on Drawings, locate at openings, walls, columns, grid lines, and inside corners. The maximum spacing of contraction (control) joints, for reinforced and unreinforced slabs, is to be 30 times the slab thickness (i.e. for a 4 inch slab the maximum spacing is 10 feet). Cut joints 1/4 times the slab thickness. The Soff-Cut Saw shall be used immediately after final finishing. A conventional saw shall be used

as soon as possible without dislodging aggregate. Schedule slab pours and saw-cutting operations such that sawing is completed prior to onset of shrinkage cracking.

2. Provide isolation joints at columns (1/2 inch thick) and at walls (1/8 inch thick). Where isolation joint will be exposed to view, set top of joint filler below top of slab a distance equal to the filler thickness, to receive sealant. Where not exposed to view, set top of filler flush with top of slab. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- D. Joints in Exterior Slabs-on-Grade: Locate joints as shown on Drawings: In the absence of information on Drawings, provide the following (sidewalks only):
1. Expansion joints: Full depth, with 1/2 inch joint filler, where slabs abut vertical surfaces, at intersection of sidewalks, at abrupt changes in width, and at a spacing not exceeding 30 feet.
 2. Control joints: Tooled, 1 inch deep, 4'-0" to 6'-0" on center between expansion joints.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Contraction Joints in Polished Concrete Floor Slabs:
1. Saw-cut slabs as soon as possible after finishing using a saw blade that has a triangular arbor configuration to reduce edge raveling or dislodging aggregates at a maximum spacing of 10-feet on center each way to minimize slab curling and cracking.
 2. Contraction joints shall be as close to square as possible.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of

weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 CONCRETE PLACEMENT, POLISHED FLOORS

- A. Transit mixer drums should be properly washed out after each concrete mix discharge and before a new batch is loaded.
- B. Water added by the transit mixer driver should be monitored and controlled.
- C. During mixing, transporting, and placing the concrete mix, monitor and control the temperature to not more than 85 degrees F.
- D. The slump at the point of discharge shall be 5 inches, plus or minus ½ inch.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS, GENERAL

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a hand-trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- D. (Apparatus Bay) Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand. Continue troweling passes and restraighten until floor is fuzzy but uniform in texture and appearance. Prevent hard troweling so as not to cause trowel burns on surface. Coordinate final finish with Owner and Architect.
 - 1. Apply a hand-trowel finish to surfaces exposed to view or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

- a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
3. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.11 FINISHING CONCRETE FOR POLISHED FLOOR SLABS

A. General: Polished Concrete Floors

1. After placement of the concrete mix, strike off the surface using a laser screed, then bull float at 90 degrees to the screed pull direction, vibrate and consolidate, and level to specified elevation. A 10-foot check rod is recommended, however, if not available bull floats shall be 6-foot long; smaller bull floats may be used on sloping surfaces.
2. When placing concrete mix at edges, use a 36-inch long metal or wood edge screed and run parallel with the formwork or edge after the initial screeding and before floating. Hand float should be parallel to the edge and performed in 24-inch increments to avoid lifting or depressing the surface. Avoid pulling excessive amounts of the concrete mix to the edges by either not using hand tools more than 24 inches from the edge, or floating in a fan direction.
3. When little or no bleed water is present and concrete mix has sufficiently hardened to support finishing equipment without causing imperfections in the surface, begin machine floating using pans and make two passes.
4. To improve the possibility of achieving the specified flatness/levelness requirements, check and re-straighten if necessary using a 10-foot or longer highway straight edge or bump cutter.
5. When machine floating edges, use pans and overrun the formed edge by 5-inches. For both walk-behind and riding equipment, make the first pass along the edge with the left side, or cutting side, of the equipment to pull down high spots of the surface. Make a second pass along the edge with the right side, or filling side of the equipment to fill low spots in the surface.
6. Steel trowel the surface in three passes without burning the surface or burning the aggregate (plastic trowel blades will prevent burning the aggregate).
7. Lightly hand or machine tool edges constructions joints and exercise care that edges are not depressed or chattered along bulkheads, formed edges, columns, and pipe penetrations.
8. Do not dust the finished surface with dry Portland cement or sand to accelerate curing and drying.
9. The finished concrete slab shall comply with the damage and stain prevention provisions specified in Section 03 3543 "Polished Concrete Finishing."

B. Floor Flatness/Levelness Criteria

1. Specified overall values of flatness, F(F) 50; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 35; and of levelness, F(L) 25; for polished concrete slabs-on-grade.
2. The floor flatness and levelness should be tested within 8-hours after completion of the final troweling operation according to ASTM E1155-14 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers by an independent testing agency experienced with the testing procedure and possessing the necessary equipment.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 4 inches (100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

F. Polished Concrete Floors

1. When exposed to weather, protect polished floors with OSB and products from Ram Board, or equal.
2. When protected from weather, protect polished floor with products from Ram Board, or equal.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least **six** month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding

- color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure **two** sets of two standard cylinder specimens for each composite sample.
 - 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

- a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Determination of the flatness and levelness of a concrete slab shall be made on the day following placement of the first concrete pour. Tests shall be made in accordance with ASTM E 1155 (ASTM E 1155M). After it is established that proper procedures are being utilized to obtain the desired results, flatness/levelness tests shall be conducted only as directed by the Owner.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 3000

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SECTION 03 3543 - POLISHED CONCRETE FINISHING

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 specifies preparation and finishing of new concrete to the limits indicated on the Drawings:
 - 1. Grinding concrete.
 - 2. Application of concrete silicate hardener.
 - 3. Polishing concrete.
 - 4. Sealing of finished concrete floors.

1.3 PERFORMANCE REQUIREMENTS

- A. ADA Coefficient of Friction: Meets or exceeds ADA COF of 0.60 for accessible routes and 0.80 for ramps tested in accordance with ASTM C 1028.
- B. Concrete: Minimum concrete compressive strength of 3500psi, normal weight with non-air entrained concrete.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
- B. Qualification Data: For installers.
- C. Special Finish System Description: For each phase of finishing process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work to include but not limited to the following:
 - 1. Submit Special Concrete Floor System specifications and test data.
 - 2. Submit special concrete finishes describing product to be provided, giving manufacturer's name and product name for the specified material proposed to be provided under this section.

3. Submit special concrete finishes manufacturer's recommended installation procedures; which when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.
4. Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.
5. Submit special concrete finishes manufacturer's Material Safety Data Sheet (MSDS) and other safety requirements.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Installer that employs workers trained and certified by manufacturer to apply concrete special finishes as indicated by this Section. Provide letter of certification from the manufacturer.
 1. Installer's project superintendent or principal field installer shall be a manufacturer's trained installer.
 2. Installer shall provide adequate number of skilled workmen who are thoroughly trained and experienced in the application of finish system of comparable size.
 3. Applicator should have successfully performed a minimum of 5 projects of at least 5000 square feet each.
- B. **Manufacturer's Certification:** Submit letters of acceptance by product manufacturer certifying that installers are approved to apply their products and have completed the manufacturer's installer training program within the calendar year demonstrating the installer is familiar with proper procedures and installation requirements required by the manufacturer.
- C. **Source Limitations:** Obtain concrete patching and rebuilding materials through one source from a single manufacturer.
- D. **Field Mockups:** Build (1) mockup for floor joint repair and concrete floor finishing system demonstrating aesthetic effects and setting quality standards for materials and execution.
 1. Each mockup shall be minimum 25 feet square at location selected by the Architect.
 2. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in mockup panels.
 3. Obtain written approval of the mockup from Architect prior to start of special finish work.
 4. Retain approved mockup through completion of the Work for use as a quality standard for finished work.
 5. Remove mockup when directed
- E. **Preconstruction Conference:** Conduct conference at Project site before concrete slab placement and start of application of concrete finish system. Attendance the Contractor, Architect, concrete installer, concrete floor finish installer, and finish system manufacturer's representative. Review environmental regulations, test area procedures, protection of surrounding areas, surface preparation, application, field quality control, final

cleaning, and coordination with other work, complying with requirements in Division 01 Section "Project Management and Coordination" and including the following agenda items:

1. Physical requirements of completed concrete slab and Slab finish.
2. Concrete curing method
3. Locations and time of test areas.
4. Protection of surfaces not scheduled for finish application.
5. Surface preparation.
6. Application.
7. Repair.
8. Quality control.
9. Cleaning.
10. Protection of finish system.
11. Coordination with other work.
12. Removal of concrete waste slurry.

F. Concrete Floor Protection:

1. All hydraulic powered equipment shall be diapered to avoid staining of the concrete.
2. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
3. Prevent pipe cutting machine use on interior floor slabs.
4. Omit placing steel on interior slab to avoid rust staining.
5. All equipment must be equipped with non-marking tires.
6. Do not drag or drop equipment or material across the slab which may scratch or chip the concrete.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

1.7 PROJECT CONDITIONS

A. Environmental limitations:

1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
 - a. Concrete shall have overall Floor Flatness rating of at least 40 and a local Floor Flatness of 35 per ASTM E1155. Coordinate with Section 03300-Cast-in-Place Concrete for desired floor levelness and flatness.

- b. Concrete shall be cured a minimum of 28 days or as directed in writing by the manufacturer before application of hardener densifier can begin.
- B. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.
- C. The completed slab will be covered to prevent damage by the other trades during project completion. A product equal to Ram Board floor protection material in 38" x 100' rolls and minimum 46 mil thickness shall be used and maintained.
- D. Temperature Limitations: Do not apply when surface and air temperature are below 40 degrees F or above 95 degrees F unless otherwise indicated by manufacturer's written instructions.
- E. Do not apply when surface and air temperatures are not expected to remain above 40 degrees F for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- F. Do not apply under windy conditions such that the concrete surface treatment may be blown to surfaces not intended.
- G. Do not apply to frozen substrate. Allow adequate time for substrate to thaw, if freezing conditions exist before application.
- H. Do not apply earlier than 24 hours after rain or if rain is predicted for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- I. Temporary Lighting: Minimum 200 W light source, placed 8 feet (2.5 m) above horizontal concrete surface, for each 425 square feet (40 sq m) of concrete being finished.
- J. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- K. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction. Revise manufacturer's indicated products for compliance to VOC requirements.
- B. Hardener Densifier Lithium Silicate Treatment: A water-based chemically reactive penetrating lithium silicate sealer and hardener treatment reacting with the calcium hydroxide from concrete hydration to produce insoluble calcium silicate hydrate.

Basis of Design Product: Subject to compliance with requirements provide Prosoco Consolideck LS.

- C. Concrete Hardener and Sealer: High-gloss penetrating sealer, lithium silicate hardener.
 - 1. Basis of Design Product: Subject to compliance with requirements provide Prosoco Consolideck LS Guard.

D. Concrete Sealer: Penetrating water and oil repellent.

1. Basis of Design Product: Subject to compliance with requirements provide Prosoco Consolideck SLX 100 Water & Oil Repellent

2.2 MIXES

A. Mix products, in clean containers, according to manufacturer's written instructions.

1. Do not add water, thinners, or additives unless recommended by manufacturer.
2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
3. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.
- B. Verify that base slab meets finish and surface profile requirements in Division 3 Section "Cast-In-Place Concrete," and Project Conditions above.
- C. Prior to application, verify that floor surfaces are free of construction latents.

3.2 PREPARATION

- A. Clean dirt, dust, oil, grease and other contaminants from surfaces that interfere with penetration or performance of specified product.
- B. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.
- C. Protect people, equipment and surrounding construction from injury resulting from concrete rehabilitation work.
 1. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape. If practical, remove items, store, and reinstall after potentially damaging operations are complete.

- D. Apply specified sealants and caulking and allow complete curing before treatment of concrete.

3.3 APPLICATION

- A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

- B. Grinding Concrete:

- 1. Mask off and/or protect areas not to be ground, polished or stained.
 - 2. Perform grinding and polishing of concrete floors, with manufacturer's recommended grit pads and multiple passes required to match approved mockup.
 - a. Polish floor to achieve to achieve the following gloss level:
 - 1) Gloss Level: 30 to 50 units at 60 degrees.
 - 2) Tolerance: Gloss plus or minus 10% deviation from approved mockup.
 - 3. Prepare floor surfaces to be stained in accordance with approved mockup and manufacturer's grinding and polishing recommendations.

- C. Hardener Densifier Lithium Silicate Treatment:

- 1. Saturate surface with silicate hardener; re-spray or broom excess onto dry spots to ensure uniform wetting. Allow minimum soak-in period recommended by manufacturer. Remove all excess material in accordance with the manufacturer's installation instructions.
 - 2. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
 - 3. Control and dispose of waste products produced by grinding and polishing operations.

- D. Concrete Sealer with Burnishing (Polishing) Treatment Where Indicated:

- 1. Sealing Coat: Uniformly apply a continuous sealing coat to hardened concrete by low-pressure spray, microfiber mop or roller according to manufacturer's written instructions.
 - 2. Burnish surface to a gloss finish using high-speed burnishing equipment consistent with approved mockup. Apply second coat and burnish where required to achieve desired finish of approved mockup.

3.4 PROTECTION OF FINISHED CONCRETE FLOORING

- A. Protect special concrete floor finish from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 3543

SECTION 04 2200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry-joint reinforcement.
 - 5. Miscellaneous masonry accessories.

- B. Products Installed but not Furnished under This Section:

- 1. Cast-stone trim in concrete unit masonry.

- C. Related Requirements:

- 1. Section 05 1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - 2. Section 07 1900 "Water Repellents" for water repellents applied to unit masonry assemblies.
 - 3. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
 - 4. Section 08 9000 "Louvers and Vents" for wall vents (brick vents).

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties, and material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Integral water repellant used in CMUs.
 - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 6. Grout mixes. Include description of type and proportions of ingredients.
 - 7. Reinforcing bars.
 - 8. Joint reinforcement.
 - 9. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 - 2. Density Classification: Normal weight, unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.

2.5 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:
- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 3000 "Cast-in-Place Concrete," and with reinforcing bars indicated.
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C 91/C 91M.
- B. Mortar Cement: ASTM C 1329/C 1329M.
- C. Aggregate for Grout: ASTM C 404.

- D. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- E. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckman Building Products, Inc.; No. 376 Rebar Positioner.
 - c. Hohman & Barnard, Inc.; #RB or #RB – Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
 - 1. Interior Walls: Mill- galvanized carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch (3.77-mm diameter).
 - 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
 - 6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- D. Masonry Cleaner:
 - 1. Use potable water and detergents to clean masonry unless otherwise acceptable.
 - 2. Unless otherwise required, do not use acid or caustic solutions.

2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into masonry but with at least a 5/8-inch (16-mm) cover on outside face.

- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.
- D. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use masonry cement or mortar cement mortar unless otherwise indicated.
 - 3. For exterior masonry, use masonry cement or mortar cement mortar.
 - 4. For reinforced masonry, use masonry cement or mortar cement mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S or Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.
 - 4. For interior nonload-bearing partitions, use Type N may be used instead of Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
 - 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
 - 1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to

receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

2. Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of ¼ inch (6 mm) and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, ½ inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.

3.9 BOND BEAMS

- A. Continuous bond beams shall be located at the following locations and as noted on the plans:
 1. Top of parapet walls
 2. Under roof framing bearing locations
 3. Floor framing bearing locations
- B. Bond beam reinforcing shall be continuous through control joints at bearing walls, unless noted otherwise on drawings.
- C. Continuous bond beams shall be located at the top of non-load bearing partition walls.
 1. Where joists pass through the concrete masonry wall, bond beam shall be lowered so the bond beam is not cut by the joist pass-thru.

3.10 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 2000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2200

SECTION 04 4313 – ANCHORED BRICK AND MASONRY VENEER

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. Decorative concrete masonry anchored to unit masonry or cold-formed metal framing and sheathing.
- 2. Face brick.
- 3. Mortar and grout.
- 4. Ties and anchors.
- 5. Embedded flashing.
- 6. Miscellaneous masonry accessories.
- 7. Cavity-wall insulation.

- B. Related Sections:

- 1. Section 04 2200 "Concrete Unit Masonry" for concrete masonry units.
- 2. Section 04 7200 "Cast Stone Masonry" for furnishing cast stone trim.
- 3. Section 05 1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
- 4. Section 05 5000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
- 5. Section 07 1900 "Water Repellents" for water repellents applied to unit masonry.
- 6. Section 07 6200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- B. Samples for Verification: For each type and color of the following:
 - 1. Face brick, in the form of straps of five or more bricks.
 - 2. Special brick shapes.
 - 3. Weep holes and vents.
 - 4. Accessories embedded in masonry.
 - 5. Stone units – at least four samples to show full range of color and texture variations.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing per ASTM C 67.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.

- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Stone: Obtain stone from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- E. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - 2. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 24 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 DECORATIVE BURNISHED CONCRETE MASONRY UNITS

- A. Description: BURNISHED MASONRY UNITS
1. Basis of Design: Premier Ultra Burnished Masonry Units as manufactured by County Materials Corporation. 205 North St. P. O. Box 100; Marathon, WI 54448-0100; Toll Free Tel: 800-242-7733; Tel: 715-848-1365; Fax: 715-443-3691; Email:[request info \(info@countymaterials.com\)](mailto:info@countymaterials.com); Web:www.countymaterials.com
 - a. Acceptable Alternate manufacturer:
 - 1) Grand Blanc Cement Products

2) Echelon Masonry – Trenwyth Trendstone

2. Description: Integrally pigmented loadbearing hollow units with a net area compressive strength of greater than or equal to 2000 psi.
3. Compliance: ASTM C 90.
4. Coloring: Integral, through-body coloring; synthetic or natural iron oxide pigments.
5. Water Repellent: Integral Water Repellent.
6. Finish: Ground Face.
 - a. Size and Shape:
 - 1) 15 5/8" high x 23 5/8" wide x 3 5/8" depth.
 - 2) 7 5/8" high x 15 5/8" wide x 7 5/8" depth.
 - b. Color: to be selected by architect from manufacturer's full range.
 - c. Sealer: Clear-drying, water-based, silicone emulsion with 6 percent solids as measured by ASTM D 5095 as recommended by manufacturer.

2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C 216.
1. Products: Subject to compliance with requirements, the brick selection shall be based on an Allowance of \$1,400/thousand.
 2. Grade: SW.
 3. Type: FBX.
 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67.
 7. Size: (Actual Dimensions): 11-5/8" wide X 3 5/8" tall by 3 5/8" deep utility size.
 8. Application: Use where brick is exposed unless otherwise indicated.
 9. Color and Texture: To be selected by architect.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce a colored mortar in the buff/tan range.
1. No observable difference in the applied finish when viewed from 10 feet.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Masonry Cement: ASTM C 91.
1. Products: Subject to compliance with requirements.
- D. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
 2. If used admixtures shall be added at the same rate for all mortar that will be exposed to view, regardless of weather conditions to ensure mortar color is consistent.
- G. Water: Potable.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or Type 316.
 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 666, Type 304 or Type 316.
 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 8. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.

- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
- C. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- D. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
 - 3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 - 4. Stone Veneer: HB Tie-HVR-195VB Anchor System for Rubble Stone or Architect approved equal.
 - 5. Brick Veneer over Metal Stud Framing: HB 2-Seal Thermal Wing Nut Anchor.

2.6 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Metal Manual," Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 - 2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.

3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76 mm) intervals along length of flashing to provide an integral mortar bond.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Cheney Flashing Company; Cheney 3-Way Flashing (Sawtooth).
 - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
 - 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
 4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing $\frac{1}{2}$ inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself $\frac{3}{4}$ inch (19 mm) at exterior face of wall and down into joint $\frac{1}{4}$ inch (6 mm) to form a stop for retaining sealant backer rod.
 7. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for $\frac{3}{4}$ inch (19 mm) and down into joint $\frac{1}{4}$ inch (6 mm) to form a stop for retaining sealant backer rod.
 8. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m copper sheet coated with flexible asphalt). Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products, Inc.; Cop-R-Cote.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Coated Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Coat Flashing.
 - 4) Phoenix Building Products; Type ACC-Ashpalt Bituminous Coated.

- 5) Sandell Manufacturing Co., Inc.; Coated Copper Flashing.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- B. Weep/Vent Products: Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from by architect from manufacturer's standard colors.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Advanced Building Products Inc; Mortar Maze weep vent.
 - 2) Dur-O-Wal; a Hohmann & Barnard company; Cell Vents.
 - 3) Wire-Bond; Cell Vent.
- C. Brick Veneer over Concrete Masonry Units: HB 270-2X Ladder Eye-Wire.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Advanced Building Products Inc.; Mortar Break II.
 - b. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - c. Mortar Net USA, Ltd.; Mortar Net.
 - 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips full depth of cavity and installed to full height of cavity.
- E. Cementitious Dampproofing for Limestone: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- F. Weep/Vent Products: Use the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50 mm) exposure on exterior and 18 inches (450 mm) in cavity behind stone masonry. Use only for weeps.

2.8 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, closed-cell product extruded with an integral skin.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 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. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use masonry cement or mortar unless otherwise indicated.
 3. For exterior masonry, use masonry cement or mortar.
 4. For reinforced masonry, use masonry cement or mortar.
 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
 - 1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches deep x 32 inches wide under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8446 "Fire-Resistive Joint Systems."

3.5 SETTING BURNISHED CONCRETE MASONRY UNITS

- A. Install only quality units; reject all defective units. Align units level, plumb and true with uniform, carefully tooled 3/8 inch (9.5 mm) wide joints on the finished side of the wall. Draw blocks from two or more pallets at a time during installation. Provide adequate lighting for masonry work by placing all lighting a reasonable distance from the wall for even illumination. Do not use trough lighting. Make all unit cuts, including those for bonding, holes, boxes, etc., with motor-driven masonry saws, using either an abrasive or diamond blade. Cut neatly for best appearance.
- B. Install concrete masonry units in accordance with standard masonry practices, and NCMA and MSJC Specifications for Masonry Structures and manufacturer's instructions.
- C. Bond Pattern for Exposed Masonry: As indicated on Drawings.
- D. Lay units by selecting product from more than one pallet at a time during installation.
- E. Lay units with full mortar head and bed joints.
- F. All cutting shall be done with masonry saw to provide, clean, sharp, unchipped edges.
- G. Do not use masonry units with broken corners and edges in excess of ASTM C90.
- H. Temporary Formwork and Shores: Construct formwork to support reinforced masonry elements during construction.

- I. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- J. Control Joints: Designed to reduce restraint and permit longitudinal movement. Per NCMA Tek Note 10-2C and 10-4, proper control joint spacing is required for concrete masonry walls.
- K. Single-Wythe Concrete Units: Joints shall not exceed the lesser of: a maximum panel length to height ratio of 1-1/2:1 or a distance of 25 feet.
- L. Concrete Facing Units: Joints shall not exceed the lesser of: a maximum panel length to height ratio of 1-1/2:1 or a distance of 20 feet.

3.6 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.7 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 12 inches clear horizontally and 16 inches clear vertically.
 4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 16 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
- C. Form expansion joints in brick as follows:
 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.
 1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches above top of pea gravel.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 2000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 4313

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SECTION 04 7200 - CAST STONE MASONRY

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. Cast stone trim including the following:
 - a. Window sills.
 - b. Lintels.
 - c. Coping.
 - d. Arches.

- B. Related Sections:

- 1. Section 04 4313 "Anchored Brick Masonry Veneer" for installing cast stone units in unit masonry.
- 2. Engineered installation shop drawings including lintels, arches, copings, etc. Drawings shall be signed by a licensed engineer registered to practice in the State of Ohio. The cast stone manufacturer shall be responsible for engineering the structural support of all cast stone elements.

1.3 ACTION SUBMITTALS

- A. Full-Size Samples: For each color, texture and shape of cast stone unit required.
 - 1. Make available for Architect's review at Project site.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- E. Mockups: Furnish cast stone for installation in mockups specified in Section 04 4313 "Anchored Brick and Stone Masonry Veneer."
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
- B. Pack, handle, and ship cast stone units in suitable packs or pallets.
 - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
 - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE UNITS

- A. Manufacturers: Continental Cast Stone (Basis of Design)
 - 1. Or equal as approved by Architect.
- B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
 - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- D. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- E. Cure units as follows:
 - 1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
- F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- G. Colors and Textures: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

2.3 SOURCE QUALITY CONTROL

- A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.
 - 1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- C. Fill anchor holes with sealant.
 - 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

- E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 - 1. Form open joint of width indicated, but not less than 3/8 inch.
- F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 9200 "Joint Sealants." Joint sealants to match cast stone in color and texture as approved by the architect. All cast stone mortar joints to be pointed with cast stone patching material as supplied by the manufacturer.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, or maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, or maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

END OF SECTION 04 7200

SECTION 05 0519 – POST-INSTALLED ANCHORS

PART 1 - GENERAL

When the information in this Specification Section conflicts with information on the Structural Construction Drawings, the Structural Construction Drawings shall prevail.

1.1 SUMMARY

A. Section Includes:

1. Requirements pertaining to post-installed anchors for materials and equipment. This section pertains to all other sections of these specifications that require post-installed anchors unless specified otherwise.

1.2 DEFINITIONS

- A. Adhesive:** Chemical components formulated from organic polymers, or a combination of organic polymers and inorganic materials that cure when blended together.
- B. Adhesive anchor:** A post-installed anchor, inserted into hardened concrete with an anchor hole diameter not greater than 1.5 times the anchor diameter, that transfers loads to the concrete by bond between the anchor and the adhesive, and bond between the adhesive and the concrete.
- C. Edge Distance:** The distance from the edge of the concrete surface to the center of the nearest anchor.
- D. Effective embedment depth:** The overall depth through which the anchor transfers force to or from the surrounding concrete. The effective embedment depth will normally be the depth of the concrete failure surface in tension applications.
- E. Expansion Anchor:** A post-installed anchor, inserted into hardened concrete that transfers loads to or from the concrete by direct bearing or friction or both. Expansion anchors may be torque-controlled, where the expansion is achieved by a torque acting on the screw or bolt; or displacement-controlled, where the expansion is achieved by impact forces acting on a sleeve or plug and the expansion is controlled by the length of travel of the sleeve or plug.
- F. Manufacturer's Printed Installation Instructions (MPII):** Published instructions for the correct installation of the anchor under all covered installation condition as supplied in the product packaging.
- G. Post-installed anchor:** An anchor installed in hardened concrete. Expansion, undercut, and adhesive anchors are examples of post-installed anchors.

- H. Primary Structural System: The completed combination of elements which serve to support the building's self weight, the applicable live load which is based upon the occupancy and use of the spaces, and the environmental loads such as wind, seismic, and thermal. Curtain wall members, non-load bearing walls and exterior facade are examples of items which are not part of the Primary Structural System.

1.3 REFERENCES

- A. ACI 318 – Building Code Requirements for Structural Concrete
- B. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete
- C. ACI 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete
- D. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
- E. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
- F. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
- G. ICC-ES AC60 – Acceptance Criteria for Anchors in Unreinforced Masonry Elements
- H. ICC-ES AC70 – Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
- I. ICC-ES AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements
- J. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- K. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 PRE-INSTALLATION MEETINGS

- A. Post Installed Anchors – Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for post installed anchors as detailed in the Quality Assurance section below.

1.5 DELEGATED DESIGN

- A. Engage a qualified professional engineer registered in the State of Ohio, as defined in Section 01 4000 "Quality Requirements," to design anchors that are not part of the Primary Structural System.

- B. For each non-structural application, provide data substantiating specified design requirements, signed and sealed by the qualified professional engineer.
- C. Select anchor type appropriate to conditions and item being fastened.
- D. If required loading capacity is not indicated on the drawings, determine required loading capacity in accordance with accepted engineering principles and as required by applicable code.
- E. Confirm application requirements for cracked and uncracked concrete substrates.

1.6 ACTION SUBMITTALS

- A. Submittals are to be in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product specifications with recommended design values and physical characteristics for adhesive, expansion and undercut anchors. DO NOT SUBMIT MANUFACTURER'S ENTIRE PRODUCT CATALOG.
- C. Quality Assurance Submittals:
 - 1. ICC ES Evaluation Reports.
- D. Manufacturer's Printed Installation Instructions (MPII)
- E. Installer Qualifications & Procedures: Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date (see below) , and a list of the personnel to be trained on anchor installation.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Post Installed anchors shall be installed by an installer with at least three years of experience performing similar installations.
- B. Installer Training: Contractor shall arrange for an anchor manufacturer's representative to provide onsite installation training for all of their anchoring products specified. Jezerinac Geers & Associates, Inc. must receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of installing anchors. Training to consist of a review of the complete installation process for post installed anchors, to include but not be limited to:
 - 1. Hole drilling procedure.
 - 2. Hole preparation and cleaning technique.

3. Adhesive injection technique and dispenser training/maintenance.
 4. Rebar dowel preparation and installation.
 5. Proof loading/torquing.
- C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have the following certification:
1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store anchors in accordance with manufacturer's recommendations.
- B. Anchoring adhesives must be stored at temperatures prescribed by the manufacturer and must not be used beyond the expiration date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Hilti Corporation, www.us.hilti.com, 1-800-879-8000.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- C. Substitutions:
 1. Due to code mandated design requirements (ACI Appendix D) anchor substitutions will only be considered on a limited basis due to high variability of design values and reduction factors unique to each anchor.
 2. As a result of the increased design complexity for checking each unique anchor from an alternative mfr. Jezerinac Geers & Associates, Inc. cannot offer anchor substitution requests as part of its basic design services. The following options are available for substitution requests:
 - a. The contractor can independently retain Jezerinac Geers & Associates, Inc. to provide additional design services required to determine the new installation requirements of the proposed anchor. Please be advised it is possible the requested anchor may not meet the required load demand.

- b. The contractor can submit calculations prepared by a structural engineer registered in the State of Ohio indicating the alternative anchor will provide the required design loading. Jezerinac Geers & Associates, Inc. will provide the maximum required design loading (tension, shear, and/or moments) for design.
- c. The alternative anchor calculations shall account for reduction factors unique to each manufacturer's anchorage method. These factors include, but are not limited to the following: Reduction factors for cracked concrete, hole drilling and cleaning methods, spacing, edge distances, concrete thickness, installed temperature ranges (adhesives), concrete conditions (i.e. dry, saturated, wet), sustained loading, seismic loading, and concrete type.

2.2 MATERIALS

A. Fasteners and Anchors

- 1. Bolts and Studs: ASTM A307; ASTM A449 where "High Strength" is indicated on the Drawings.
- 2. Carbon and Alloy Steel Nuts: ASTM A563.
- 3. Carbon Steel Washers: ASTM F436.
- 4. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
- 5. Wedge Anchors: ASTM A510; or ASTM A108.
- 6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
- 7. Stainless Steel Nuts: ASTM F594.
- 8. Zinc Plating: ASTM B633.
- 9. Hot-Dip Galvanizing: ASTM A153.
- 10. Reinforcing Dowels: ASTM A615.

2.3 POST INSTALLED ANCHORS IN CONCRETE SUBSTRATE

- A. All post installed anchors shall be head marked with a length code.
- B. Anchors in concrete shall be designed in accordance with ACI 318 Appendix D.
- C. Expansion Anchors: Expansion type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length

identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.

1. Expansion anchors shall meet the criteria of ACI 355.2.
 2. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 3. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti Kwik Bolt TZ, ICC ESR-1917 (carbon steel and AISI Type 304 Stainless Steel).
- D. Screw Anchors: Screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8µm min.).
 2. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti Kwik-HUS-EZ, ICC-ESR 3027.
- E. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
1. Adhesive anchors shall meet the criteria of ACI 355.4.
 2. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM F1554 Grade 36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) or carbon steel HIT TZ rods conforming to ASTM A510 with chemical composition of AISI 1038.
 3. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts

and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

4. Reinforcing dowels shall be A615 Grade 60.
5. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide one of the following:
 - a. Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete, ICC ESR-3187.
 - b. Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.

2.4 POST INSTALLED ANCHORS IN MASONRY SUBSTRATE

A. Expansion Anchors for Grout-Filled Concrete Masonry Units

1. Expansion anchors are post-installed torque-controlled mechanical expansion anchors used to transmit structural loads by means of tension, shear, or a combination of both between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in fully grouted concrete masonry units. Such anchors shall be imperial sized, threaded stud with an integral cone expander, expansion clip, nut and washer. The stud shall be manufactured from carbon steel. The expansion clip shall be manufactured from carbon steel. Carbon steel anchors shall have an electroplated zinc finish in accordance with ASTM B633, Class SC1, Type III or shall be mechanically galvanized in accordance with ASTM B695, Class 55, Type 1, as appropriate. Anchors shall have an evaluation report issued by ICC-ES and have been tested and qualified for performance in grout-filled concrete masonry in accordance with ICC-ES AC01 for all mandatory tests.
2. Expansion anchors for grout-filled concrete masonry units shall be:
 - a. Hilti Kwik Bolt 3 Anchor ICC-ES ESR-1385.

B. Adhesive Anchors for Grout-Filled Concrete Masonry Units

1. An adhesive anchor shall consist of: 1) threaded rod or reinforcing bar insert; and 2) adhesive formula. Threaded rod inserts shall meet the minimum requirements of ASTM F1554 Grade 36, ASTM A193 Grade B7, ASTM A193 Grade B6 (Type 410 Stainless Steel) or ASTM A193 Grade B8 and B8M (Types 304 and 316 Stainless Steel). Reinforcing bar inserts shall meet the minimum requirements of ASTM A615 Grade 40. For exterior exposure the insert shall be stainless steel. Inserts in contact with preservative-treated and fire-retardant-treated wood shall be zinc coated in accordance with ASTM A153 Class C or D or stainless steel or demonstrated

through tests to be equivalent to the coatings described. Adhesives shall be injectable, two-component, cartridge-type systems dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation.

2. Adhesive anchors are post-installed anchors used to transmit structural loads by means of tension, shear, or a combination of both between: (a) connected structural elements; or (b) safety-related attachments and structural elements. Adhesive anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in fully grouted concrete masonry units. Adhesive anchors shall have an evaluation report issued by ICC-ES and have been tested and qualified for performance in grout-filled concrete masonry units in accordance ICC-ES AC58 for all mandatory tests.
3. Adhesive anchors for grout-filled concrete masonry units shall be:
 - a. Hilti HIT-HY 70
 - 1) Steel anchor shall be Hilti HAS-E continuously threaded rod or continuously deformed steel rebar.

C. Adhesive Anchors for Hollow Concrete Masonry Units

1. An adhesive anchor shall consist of: 1) threaded rod insert; 2) adhesive formula; and 3) carbon steel, stainless steel or plastic screen tube. Threaded rod inserts shall meet the minimum requirements of ASTM F1554 Grade 36, ASTM A193 Grade B7, ASTM A193 Grade B6 (Type 410 Stainless Steel) or ASTM A193 Grade B8 and B8M (Types 304 and 316 Stainless Steel). For exterior exposure the insert shall be stainless steel. Inserts in contact with preservative-treated and fire-retardant-treated wood shall be zinc coated in accordance with ASTM A153 Class C or D or stainless steel or demonstrated through tests to be equivalent to the coatings described. Adhesives shall be injectable, two-component, cartridge-type systems dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation.
2. Adhesive anchors are post-installed anchors used to transmit medium duty, non-seismic loads to hollow concrete masonry units by means of tension, shear, or a combination of both. Adhesive anchors shall be assigned allowable tension and shear loads for designs based on allowable stress design in hollow concrete masonry units. Adhesive anchors shall have been tested and qualified for performance in hollow concrete masonry units.
3. Adhesive anchors for hollow concrete masonry units shall be:
 - a. Hilti HIT-HY 70

- 1) Steel anchor shall be Hilti HAS-E continuously threaded rod or continuously deformed steel rebar (use with appropriately sized screen tube).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Install only if environmental conditions are in compliance with manufacturer's recommendations for installation conditions.

3.2 PREPARATION

- A. Verify on-site training of installers has been completed.
- B. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors.
 1. Existing reinforcing bars in the structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the post installed anchors by Hilti Ferrosan, GPR, X-RAY, chipping, or other means.
 2. Exercise care in drilling to avoid damaging existing reinforcing or embedded items.
 3. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
 4. DO NOT DRILL THROUGH REINFORCING without first contacting the Engineer of Record.
 5. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Clean holes for post installed anchors per MPII.
 1. Where holes are drilled and cleaned in advance of anchor installation, it must be verified that the holes are protected from intrusion of contaminants or moisture (e.g., rainwater) during the interim period, or that the cleaning steps are performed immediately prior to anchor installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General:

1. Adhesive anchors shall be installed in concrete having a minimum age of 21 days at time of anchor installation.
2. Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete or masonry. Install anchors in accordance with spacing and edge clearances indicated on the drawings.

B. Perform anchor installation in accordance with MPII.

C. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the Engineer of Record.

D. Drill holes for adhesive anchors with rotary impact hammer drills using carbide-tipped bits, or hollow drill bit system. Cored holes are not permitted for adhesive anchor applications. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.

1. Cored Holes: Do not use cored holes for adhesive anchors. Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
2. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

E. Cartridge Injection Adhesive Anchors:

1. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive.
2. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
3. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface.
4. Shim anchors with suitable device to center the anchor in the hole.
5. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

F. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors.

3.4 FIELD QUALITY CONTROL

- A. The Architect/Engineer reserves the right to require the anchor manufacturer's representative to demonstrate proper installation procedures for post-installed anchors and to observe Contractor's installation procedures, at no extra cost to Owner.
- B. The Architect/Engineer reserves the right to require pullout or shear tests to determine adequacy of anchors, at no extra cost to Owner.
- C. Special Inspections – Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Continuous special inspection – The special inspector shall observe all aspects of the anchor installation with the exception of holes drilled in the absence of the special inspector, provided the special inspector examines the drill bits used for the drilling and verifies the hole sizes.
 - 2. Periodic special inspection – The special inspector shall verify the initial installation of each type and size of adhesive anchor by construction personnel on site in accordance with the items noted in the sections below. Subsequent installations of the same anchor type and size by the same construction personnel shall be permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation shall require an initial special inspection in accordance with the requirements below. For ongoing installations over an extended period, the special inspector shall make regular inspections to confirm correct handling and installation of the product.
 - 3. Mechanical Anchors – Periodically inspect and verify the following items:
 - a. Hole drilling method in accordance with MPII.
 - b. Anchor edge distance and spacing.
 - c. Hole diameter and depth.
 - d. Hole cleaning in accordance with the MPII.
 - e. Anchor element type, material, diameter, and length.
 - f. Where anchors are installed in a slab on grade, check that the hole drilling procedures do not result in breaking through to the underside of the slab.
 - g. Torque wrenches are calibrated properly.
 - h. Anchor threads are undamaged and not fouled.
 - i. During setting of torque-controlled expansion anchors, the inspector will note the number of full turns required to achieve the required torque.

4. Cartridge injection Adhesive Anchors – Periodically inspect and verify the following items:
 - a. Minimum concrete cure time of 21 days has passed.
 - b. Hole drilling method in accordance with MPII.
 - c. Anchor edge distance and spacing.
 - d. Hole diameter and depth.
 - e. Hole cleaning in accordance with the MPII.
 - f. Anchor element type, material, diameter, and length.
 - g. Anchor elements (threaded rod, reinforcing bars, internally threaded sleeves) are free of substances that might interfere with bond (e.g., dust, mud, oil).
 - h. Reinforcing bars are free of loose rust.
 - i. Anchor threads are undamaged and not fouled.
 - j. Concrete temperature in-situ verified prior to installation for conformance with the requirements of the MPII and to establish the cure time for the adhesive.
 - k. Adhesive identification and expiration date.
 - l. Adhesive installation in accordance with MPII.
 - m. Anchor position is true (angle with respect to the concrete surface), and that the anchor is secured against movement during the cure time.

3.5 REPAIR OF DEFECTIVE WORK

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

END OF SECTION 05 0519

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- B. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.
- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
 - 1. Fabrication facility is to be a member of the American Institute of Steel Construction (AISC).
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- F. Survey of existing conditions.

- G. Source quality-control reports.
- H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firms acceptable as fabricators for structural steel work under this Section shall be certified in the category of "Standard for Steel Building Structures (BU)" by the American Institute of Steel Construction or shall include in their bid all costs to cover inspections by an independent testing agency to verify that the fabricator is capable of performing the desired level of quality in the work to be performed. The fabricator shall cooperate with and make available to the testing agency records and documents which focus on general management, engineering and drafting, procurement, operations and quality control and shall allow access to facilities to allow the testing agency to examine actual fabrication work in the shop and drafting room at the time of the inspection. The inspection will be performed prior to the signing of a contract between the Owner and the Fabricator and will be the basis of recommendations from the A/E to the Owner as to the qualifications of the fabricator to perform the work.
- B. Installer Qualifications: Minimum five years continuous in similar scope steel erection.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 1. Select and complete connections using [schematic details indicated and AISC 360.
 2. Use Allowable Stress Design; data are given at service-load level.
- B. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.s
- F. Welding Electrodes:
 1. Use E70XX electrode unless noted otherwise.
 2. Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- G. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 3. Finish: Plain.
- H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

H. Closure Plates: Provide minimum 1/4 inch closure plates at all Hollow Structural Steel tube ends, U.N.O. on plans.

2.7 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- a. Liquid Penetrant Inspection: ASTM E 165.
- b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- c. Ultrasonic Inspection: ASTM E 164.
- d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 1200

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SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof deck.
- 2. Composite floor deck.
- 3. Noncomposite form deck.

- B. Related Requirements:

- 1. Section 03 3000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
- 2. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
- 3. Section 09 9123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40 (275), G90 (Z275) zinc coating.
 - 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40 (275), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard
 - 3. Deck Profile: As indicated.
 - 4. Profile Depth: As indicated.
 - 5. Design Uncoated-Steel Thickness: As indicated.
 - 6. Span Condition: Triple span or more.
 - 7. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G30 (Z90) zinc coating.
 - 2. Profile Depth: As indicated.

3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.

2.4 NONCOMPOSITE FORM DECK

- A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G30 (Z90) zinc coating.
 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth, unless noted otherwise on plan.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

- H. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: ASTM A 780/A 780M.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Weld Diameter: As indicated on drawings.
 - 2. Weld Spacing: As indicated on drawings.
- B. Side-Lap and Perimeter Edge Fastening: As indicated on drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: As indicated on drawings.
 - 2. Weld Spacing: Space and locate welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location, per deck supplier recommendations.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914 mm), and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm) with end joints as follows:
 - 1. End Joints: Lapped.

- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 3100

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Load-bearing wall framing.
 - 2. Interior non-load-bearing wall framing.
 - 3. Soffit framing.

- B. Related Requirements:

- 1. Section 05 5000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 - 2. Section 09 2216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings:

- 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of code-compliance certification for studs and tracks.

- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Standards: Comply with American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Structural Steel Members", except as otherwise indicated.
 - 1. The minimum uncoated thickness of the cold-formed framing delivered to the project shall not be less than 95 percent of the design thickness indicated. Lesser thicknesses shall be permitted at the bends due to cold forming.
- B. Testing Agency Qualifications: Minimum three years' experience in similar inspection, qualified according to ASTM E 329 for testing indicated.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- E. Fire-rated assemblies: Where work is indicated to comply with fire-resistance ratings, provide materials and installations identical to applicable tested and listed components and assemblies.
- F. Provide each type of cold-formed metal framing required produced by one manufacturer.
- G. Reference standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process."
 - b. ASTM A780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings."

- c. ASTM A924 "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process."
 - d. ASTM A1003 "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members."
 - e. ASTM C955 "Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases."
 - f. ASTM C1007 "Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories."
2. American Welding Society (AWS):
- a. AWS A2.4 "Symbols for Welding and Nondestructive Testing."
 - b. AWS D1.1 "Structural Welding Code-Steel."
 - c. AWS D1.3 "Structural Welding Code-Sheet Steel."
3. Association of Wall and Ceiling Industries-International (AWCI) and Metal Lath/Steel Framing Association (ML/SFA):
- a. AWCI-ML/SFA "Steel Framing Systems Manual."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of thickness and grade as follows:
 - 1. Design Thickness:
 - a. 33 mils – 0.0346 inches – 20 gage.
 - b. 43 mils – 0.0451 inches – 18 gage.
 - c. 54 mils – 0.0566 inches – 16 gage.
 - d. 68 mils – 0.0713 inches – 14 gage.
 - e. 97 mils – 0.1017 inches – 12 gage.

2. 43 mils (18 gage) and lighter C-shaped components: minimum yield point of 33,000 psi.
 3. 54 mils (16 gage) and heavier C-shaped components: minimum yield point of 50,000 psi.
 4. Track and bridging components: minimum yield point of 33,000 psi.
 5. Connection Clip Angles and Vertical or Horizontal Deflection Angle connections: minimum yield point of 50,000 psi.
- B. Sustainability Requirements:
1. All steel for cold-formed metal framing members and shapes shall have a minimum 25% post-consumer recycled content.
- C. Framing Components: Manufacturer's standard C-shaped cold-formed metal studs having punched and/or un-punched webs with stiffened flanges shall comply with ASTM C955. Provide sizes, shapes, and gages indicated. Nomenclature used on the drawings is designated by: Depth, Shape, Width, and Thickness of framing components. i.e.: 600S162-54.
1. Depth: The number represents the depth of the member multiplied by 100 and expressed as a whole number. i.e.: $362 = 3 \frac{5}{8}"$, $600 = 6"$, $800 = 8"$.
 2. Shape: S – C-shaped members; T – track member; F – furring channel; U – U-shaped channel.
 3. Width: The number represents the flange width of the member multiplied by 100 and expressed as a whole number. i.e.: $162 = 1 \frac{5}{8}"$; $200 = 2"$; $250 = 2 \frac{1}{2}"$.
 4. Thickness: Expressed in mils as defined above.
- D. System Accessories: Provide manufacturer's standard steel tracks, bridging, blocking, clip angles, reinforcements, stiffeners, fasteners, braces, and accessories for each type of cold-formed metal framing required. Provide all components recommended by the manufacturer for the applications indicated and as needed to provide a complete metal framing system.
- E. Finish:
1. Galvanized: Provide framing components; studs, joists, rafters, and headers, with protective zinc coating complying with ASSTM A1003, minimum G60 coating.
 2. Provide connection components; clip angles, deflection angles, joist hangers, hurricane ties, holdowns, etc., with protective zinc coating complying with ASTM A1003, minimum G90 coating.
 3. Galvanizing repair paint: Tnemec Co., Inc. – No. 92 "Tneme-Zinc"; SSPC-Paint 20; or an approved equal zinc-rich primer paint.
- F. Fasteners:
1. Manufacturer's recommended self-drilling, self-tapping screws, bolts, nuts, and washers with hot-dip galvanized finished complying with ASTM C1513.

2. Anchorage devices: Powder-actuated fasteners (PAF), anchor bolts, drilled expansion anchors, or chemical anchors.
 3. Welding: Comply with AWS D1.1 when applicable, and AWS D1.3 for welding base metals less than 1/8" thick.
- G. Non-Metallic, Non-Shrink Grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing agents, and water-reducing agents, complying with ASTM C1107, with a fluid consistency and 30-minute working time having a minimum 28-day compressive strength of 5,000 psi.
- H. Shims: Load bearing, high-density multimonomer plastic, non-leaching.
- I. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Flange Width: As indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Flange Width: As indicated.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Flange Width: As indicated.
- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Top Flange Width: As indicated.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 2. Flange Width: 2 inch (50 mm).
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - b. Flange Width: 2 inch (50 mm).
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - b. Flange Width: 3 inch (75 mm) >.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 2 inches (51 mm), minimum.

2.6 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As indicated on Drawings, at 24 inches (610 mm) on center max.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.

2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches (1220 mm). Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings, but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.

- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

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. Steel framing and supports for overhead doors.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Shelf angles.
7. Miscellaneous steel trim including steel angle corner guards.
8. Metal bollards.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

- C. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 2200 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 1200 "Structural Steel Framing."
4. Section 05 5100 "Metal Stairs" for cast and extruded treads and nosings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings and treads.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Steel Wide Flange Sections: ASTM A 992/A 992M.
- G. Treadplate around training openings shall be 1/8" thickness, type 6061 Aluminum Diamond Plate- Mill Finish.

2.3 FASTENERS

- A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.

- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Provide bearing plates welded to beams where indicated.
 - 2. Drill or punch girders and plates for field-bolted connections where indicated.

3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes as indicated on the Drawings, 24 inches (600 mm) o.c. max.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 2. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.
- E. Galvanize miscellaneous framing and supports where indicated and/or where exposed to weather.

2.7 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3.
- B. Steel Ladders:
 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
 3. Rungs: 1-inch- (25-mm-) diameter steel bars.
 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
 8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 9. Galvanize and prime ladders, including brackets.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe, as indicated.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for ceiling hung toilet partitions, operable partitions, overhead doors, and overhead grilles securely to, and rigidly brace from, building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 5000

SECTION 05 5113 - METAL PAN STAIRS

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. Preassembled steel stairs with concrete-filled and abrasive-coating-finished, formed-metal treads.
 - 2. Steel tube railings attached to metal stairs.
 - 3. Steel tube handrails attached to walls adjacent to metal stairs.
 - 4. Railing gates at the level of exit discharge.

- B. Related Requirements:

- 1. Section 03 3000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:

- 1. Prefilled metal-pan-stair treads.
 - 2. Nonslip aggregates and nonslip-aggregate finishes.

3. Abrasive nosings.
4. Paint products.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type and finish of nosing and tread.
- D. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design stairs and railings.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
- b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

- a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
- b. Infill load and other loads need not be assumed to act concurrently.

- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, Grade B.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast iron or aluminum, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Configuration: Cross-hatched units, 4 inches (100 mm) wide without lip.
- B. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
 2. Provide solid-abrasive-type units without ribs.
 3. Nosings: Square-back units, 4 inches (100 mm) wide, without lip.
 4. Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized, and stairs indicated to be shop primed with zinc-rich primer.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
- F. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- G. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).

1. Steel Sheet: Uncoated cold- or hot-rolled steel sheet unless otherwise indicated.
2. Steel Sheet: Galvanized-steel sheet, where indicated.
3. Directly weld metal pans to stringers; locate welds on top of subreads where they are concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. Attach abrasive nosings to risers.
7. At Contractor's option, provide stair assemblies with metal pan subreads filled with reinforced concrete during fabrication.
8. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.
9. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.

- a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

- D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.097 inch (2.5 mm).

1. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

2.8 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inches- (38-mm-) diameter top and bottom rails.
2. Picket Infill: 3/4-inch- round pickets spaced less than 4 inches (100 mm) clear.

- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.

- C. Form changes in direction of railings as follows:
 - 1. As detailed.
 - 2. By bending or by inserting prefabricated elbow fittings.
 - 3. By flush bends or by inserting prefabricated flush-elbow fittings.
 - 4. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 03 3000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding or bolting to steel supporting members.
 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements, and as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry anchorage, use toggle bolts.
 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
 5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting." Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 5113

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Wood blocking and nailers.

- B. Related Requirements:

- 1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 06 1753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NHLA: National Hardwood Lumber Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
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.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with

fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Concealed blocking.
 - 3. Roof framing and blocking.
 - 4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 - 5. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Other Framing: No. 2, Construction, or Stud grade of any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Southern pine or mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2, Standard, or Stud grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.

C. Utility Shelving: Lumber with 19 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine No. 1 or No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002 and ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere

with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- I. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. 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.
 - 3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

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SECTION 06 1600 - 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. Section Includes:

- 1. Wall sheathing.
- 2. Roof sheathing.
- 3. Sheathing joint and penetration treatment.

- B. Related Requirements:

- 1. Section 06 1000 "Rough Carpentry" for plywood backing panels.
- 2. Section 07 2500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION 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, 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 waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect the edges of panels, especially tongue-and-groove panels. Place panels to be moved by forklift on pallets or bunks when received to avoid damage by fork tines.
- B. Panels to be transported on open truck beds should be covered with standard tarpaulins or "lumber wraps."
- C. Whenever possible, store panels under a roof, especially if they will not be used soon after received. Keep sanded and other appearance grades away from open doorways, and weight down the top panel in a stack to help avoid any possible warpage from humidity. If moisture absorption is expected, cut steel banding on panel bundles to prevent edge damage.
- D. Panels to be stored outside should be stacked on a level platform supported by 4x4 stringers or other blocking. Never leave panels or the platform in direct contact with the ground. Use at least three full-width supports along the 8-foot length of the panel – one centered and the others 12 to 16 inches from each end.
- E. Cover the stack loosely with plastic sheets or tarps. Anchor the coverings at the top of the stack, but keep it open and away from the sides and bottom to assure good ventilation. Tight coverings prevent air circulation and, when exposed to sunlight, create a "greenhouse" effect which may encourage mold formation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated. APA performance category shall be equal to the nominal panel thickness.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.
- C. 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.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 1. Roof sheathing.

2. Wall sheathing.

2.4 WALL SHEATHING

- A. Paper-Surfaced Gypsum Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 1. Type and Thickness: Regular, 1/2 inch (13 mm) thick.
 2. Edge and End Configuration: V-shaped, tongue-and-groove long edges; square ends.
 3. Size: 48 by 96 inches (1219 by 2438 mm) or 48 by 108 inches (1219 by 2743 mm) for vertical or horizontal installation.

2.5 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Cornell Corporation.
 - c. Hunter Panel (Cool-Vent)
 - d. Rmax, Inc.
 2. Polyisocyanurate-Foam Thickness: 3.5 inches.
 3. Oriented-Strand-Board Nominal Thickness: 7/16 inch.
 4. Airspace: 1"
 5. Overall panel thickness: 5" to obtain a minimum LTTR of 20.5.

2.6 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.
 1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 19/32 inch.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.
 1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 5/8 inch.

2.7 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: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- 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.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Paper-Surfaced Gypsum Sheathing: 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 Section 079200 "Joint Sealants."

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. Arrange joints so that pieces do not span between fewer than three support members.
- 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. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- 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 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing (General):
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 - 2. Wall sheathing (Non-Shear Wall):
 - a. Fasten to cold-formed metal framing with #10 screws at 6 inches o.c. at panel edges and 12 inches o.c. at intermediate supports.
 - b. Fasten to wood framing with 8d common nails at 6 inches o.c. at panel edges and 12 inches o.c. at intermediate supports.
 - c. At exterior walls: all panel edges to be blocked solid.
 - 3. Roof Sheathing:

- a. Where noted on plan, block ALL panel edges (4-sides) with minimum 2x4 wood blocking. Blocking may be installed flatwise.
- b. Fasten to wood framing with 10d common nails at 6 inches o.c. at supported panel edges and 12 inches o.c. at intermediate supports, unless otherwise indicated.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to wood framing with nails or screws.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 4. Install panels with a 1/4-inch (6.4-mm) 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, 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 panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 1. Space fasteners approximately 7 inches (175 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 1. Space fasteners approximately 7 inches (175 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

END OF SECTION 06 1600

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SECTION 06 1753 - SHOP-FABRICATED WOOD TRUSSES

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. Wood roof trusses.
 - 2. Wood girder trusses.
- B. Related Requirements:
 - 1. Section 04 2200 "Concrete Unit Masonry."
 - 2. Section 05 1200 "Structural Steel Framing."
 - 3. Section 05 4000 "Cold-Formed Metal Framing."
 - 4. Section 06 1053 "Miscellaneous Rough Carpentry."
 - 5. Section 06 1600 "Sheathing."

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For wood-preservative-treated lumber, fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification from treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Indicate design loads, allowable stress increases, and axial forces in members.
7. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For metal connector-plate manufacturer, professional engineer, and fabricator.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated lumber.
 2. Fire-retardant-treated wood.
 3. Metal-plate connectors.
 4. Metal truss accessories.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. The trusses shall be designed to meet the following deflection criteria when the total design loads are applied:
 - a. Roof Trusses:
 - 1) L/240 when supporting a suspended ceiling.
 - 2) L/360 when supporting a finished ceiling directly applied to the bottom chord, with or without metal furring channels.
 - 3) L/480 when supporting operable walls and partitions. Coordinate design loads and stacking requirements with the wall supplier.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S.
 4. Minimum grade for truss chords to be SPF No.2/No.2, KD. Moisture content of lumber shall not be more than 15 percent or less than 7 percent at time of fabrication.
- B. Minimum Specific Gravity for Top Chords: 0.42.
- C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 1053 "Miscellaneous Rough Carpentry."

2.3 FIRE-RETARDANT-TREATED WOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant

progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use for interior locations where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing and framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.4 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for wood-preservative-treated lumber and where indicated.

2.5 FASTENERS

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

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, or of Type 304 stainless steel.

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

2.6 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 1. Use for wood-preservative-treated lumber and where indicated.
- D. Truss Tie-Downs: As indicated on structural drawings.
- E. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Typical, unless noted otherwise on structural drawings. Clip is fastened to truss through slotted holes to allow for truss deflection.
- F. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- (44-mm-) long seat; formed from metal strap 0.062 inch (1.6 mm) thick with tabs bent to extend over and be fastened to supporting member. Typical, unless noted otherwise on structural drawings.
- G. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches (38 mm) wide by 1 inch (25 mm) deep by 0.040 inch (1.0 mm) thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses. Typical, unless noted otherwise on structural drawings.
- H. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.

1. Angle clip is 3 by 3 by 0.179 by 8 inches (76 by 76 by 4.55 by 203 mm) with extended leg 8 inches (203 mm) long. Connector has galvanized finish.
2. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches (76 by 76 by 6.07 by 267 mm) with extended leg 10-1/2 inches (267 mm) long. Connector has painted finish.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.8 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
 2. All joints shall be designed as set forth in TPI standards. Open joints which depend on the stiffness of the metal connector plate to transmit stresses and improperly fitted joints are not permitted.
- D. Lumber defects, such as wane and knots, occurring in the connector plate area must not affect more than 10% of required plate area or number of effective teeth required for each truss member. Apply connector plates to both faces of truss at each joint, making firm, even contact. Cut wood members accurately. Fabricate with wood members in good contact and all trusses uniform. Field connections of truss subassemblies, where necessary, shall be in accordance with details shown on reviewed truss-engineering drawings.
- E. Build camber into the trusses, as required for dead load deflections, by properly positioning the member in the fabrication jig.
- F. Where field connections of the truss subassemblies are necessary, special nail-on splice plates are acceptable, providing the plate sizes and positions are shown on the truss engineering design as approved by the professional engineer.
- G. Unless specifically noted otherwise on the approved shop drawings submittal, all members of multiple trusses shall be bolted together with 3/8" diameter bolts spaced at 48" on center.
- H. Provide framing anchors as shown on the engineering design drawings.

- I. Stamp each truss with the name and address of the truss fabricator, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses 24 inches (610 mm) o.c. max.; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 1. Install bracing to comply with Section 06 1053 "Miscellaneous Rough Carpentry."
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 06 1753

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SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK

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:
 - 1. Plastic-laminate cabinets.
 - 2. Plastic-laminate casework.
 - 3. Plastic-laminate countertops.
 - 4. Closet and utility shelving.
 - 5. Solid Surface tops and integral sinks and solid surface window sills.
 - 6. Interior solid surface trim.
 - 7. Solid surface shower surrounds and bases.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.
- C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 2. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.
 3. Lumber with or for transparent finish, not less than 24" long for each species and cut finished on 1 side and 1 edge.
- D. Product Certificates: For each type of product, signed by product manufacturer.
- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates. Fabricator must be AWI Certified.
- F. Qualification Data: For fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Quality Standard: Unless otherwise indicated, comply with AWT's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- D. Mockups: Build mockups to verify selections made under Sample Submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion. Mockup of 15" wide base cabinet required.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- F. Installation of all casework items must be performed by the fabricator.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWT's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Maple, plain sawn.
- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Drawings.
- E. Solid-Surfacing Materials: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Drawings.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware."
- B. Hinges: 2 ½ inch, 5-knuckle steel hinges made from 0.093 inch thick metal as follows:
 - 1. Product: Rockford Process Control (RPC) Model No. 376-101 with hospital tip non-removable pin.
 - 2. Semiconcealed Hinges for Flush Overlay Doors: BAMA A156.9.
 - 3. Finish: 26D Dull Chrome.
- C. (Kitchen Only) Frameless Concealed Hinges (European Type): BHMA A156.9, Type B01602, 125 degrees of opening, self-closing. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
- D. Door and Drawer Pulls: Back mounted, Amerock 96mm stainless steel, BP 76312CSG10, 4" etc.
- E. Adjustable Shelf Standards and Supports: Knappe and Vogt #255 Steel Standards and #256 Steel Supports.
- F. Closet Shelf Standards and Supports: Knappe and Vogt KV185 Heavy Duty Double Slotted Shelf Brackets and KV85 Heavy Duty Double Slotted Shelf Standards, 1198 Shelf/Rod warm white.
- G. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.
 - 2. (Kitchen Only) Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Concealed undermount; full-overtravel-extension type; zinc-plated steel ball-bearing slides; integrated soft-close; air dampening.
 - 3. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide - Accuride #3832 (Hafele #).

4. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide - Accuride #3640-A (Hafele #).
 5. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide - Accuride #2006, $\frac{3}{4}$ extension.
- H. Grommets for Cable Passage through Countertops 3-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- K. Locker Hardware: KVI Clothing Carrier by Knape & Vogt.
- L. Work Station Brackets: A & M Hardware, Inc., 15" x 21" size constructed of 1/8" steel. Wood Unit: 1,000 lbs. Color: Almond.
- M. File Suspension Rails: 14 gauge steel devices by Pendaflex to accommodate hanging file folders.
- N. Catches: Amerock, large metal, single roller, 1 1/2" L x 2 1/8" W x 7/8" H.
- O. Coat Hooks: Knape and Vogt #2038 Garment Hook.
- P. Soft Close Door Dampers (Kitchen only): Grass America UniSoft Dampers.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.5 PLASTIC-LAMINATE CABINETS

- A. Grade: Premium.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Front and Back of Doors and Drawer fronts: Grade VGS
 - 4. Edges: PVC T-mold matching laminate in color, pattern, and finish.
 - a. 1mm flat PVC for doors and drawer fronts.
 - b. .018 PVC is allowable for semi-exposed edges.
 - c. 1mm white PVC is allowable for shelf edging.
- D. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

- a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
- 2. Drawer Sides and Backs: Solid-hardwood lumber.
- 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on the Drawings.

2.6 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Premium.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on the Drawings.
- D. Grain Direction: Parallel to cabinet fronts.
- E. Edge Treatment: Matching 1¼" PVC edge band.
- F. Core Material: Particleboard.
- G. Core Material at Sinks: exterior-grade plywood.
- H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.7 SOLID SURFACE COUNTERTOPS, BACKSPLASHES, SINK BOWLS, WINDOW SILLS, SHOWER BASES AND ENCLOSURES

- A. Grade: Premium.
- B. Solid-Surfacing-Material Thickness: ½ inch or as detailed on the Drawings.
- C. Colors, Patterns and Finishes: Provide materials and product that results in color and textures of exposed solid surfaces complying with the following requirements:

1. As indicated on the Drawings.
- D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing material manufacturers' written recommendations for adhesives, sealers, fabrication and finishing.
 1. Fabricate tops with loose back splashes for field application
- E. Install integral sink bowls in countertops in shop. Sink bowl model number: Corian #810.
- F. Clean-up shower and mop sink enclosures and bases to be Inpro Corporation Endurant custom shower bases and enclosures. Refer to Drawings for size and style. Wall panels to be 1/4" thickness BioPrism solid surface.
- G. Crew toilet/shower enclosures and bases to be Inpro Corporation Endurant custom shower base and enclosure. Refer to Drawings for size and style. Use Velox trench receptor base in all toilet/shower rooms with integral trench drain.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4023

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SECTION 07 1900 - WATER REPELLENTS

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 penetrating water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Cast stone.
 - 2. Clay brick masonry.
- B. Related Sections:
 - 1. Section 04 4313 "Anchored Brick Masonry Veneer" for integral water-repellent admixture for unit masonry assemblies.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Applicator.
- B. Product Certificates: For each type of water repellent, from manufacturer.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Building has been closed in for not less than 30 days before treating wall assemblies.
2. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
3. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
4. Rain or snow is not predicted within 24 hours.
5. Not less than 24 hours seven days have passed since surfaces were last wet.
6. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Degussa Corporation; Protectosil Aqua-Trete EM.
 - b. Pecora Corporation; KlereSeal 920-W.
 - c. PROSOCO, Inc.; Siloxane WB Concentrate.
 - d. Sika Corporation, Inc.; Sikagard 701W.
 - e. Symons by Dayton Superior; Siloxane/Silane 10%.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.

2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
1. Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.

- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material 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 water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect..
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1900

SECTION 07 2100 - 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. Section Includes:
 - 1. Foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.
 - 3. Loose-fill insulation.
 - 4. Vapor retarders.
- B. Related Sections:
 - 1. Section 04 2200 "Concrete Unit Masonry" for insulation installed in cavity walls and masonry cells.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - 2. Type IV, 25 psi.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Dow Chemical Company (The).
 - c. Rmax, Inc.
- D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER LOOSE FILL INSULATION

- A. Glass-Fiber Loose-Fill Insulation ASTM C 764, Type I for pneumatic application; with maximum flame-spread and smoke-developed indexes of 25, per ASTM E 84.
 - 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.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
 - 4. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. 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.
- D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

- D. 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.
- E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation 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. 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 OF BELOW-GRADE INSULATION

- A. On vertical footing and foundation wall surfaces, set insulation units loosely laid according to manufacturer's written instructions.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 4313 "Anchored Brick and Stone Masonry Veneer."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- 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. Foam-Plastic Board Insulation: Seal joints between 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. Glass-Fiber or Mineral-Wool Blanket Insulation: Install 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 the cavities, 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 not rated for or protected from contact with insulation.
 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.
- D. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."
- E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders 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 no fewer than two studs.
 - 1. Before installing vapor retarders, 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.
 - 2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- C. 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 retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 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 2100

SECTION 07 2500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wrap.
 - 2. Flexible flashing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; 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. 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 HomeWrap.
 - c. Ludlow Coated Products; Air Stop Housewrap.
 - 2. Water-Vapor Permeance: Not less than 56 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 - 3. Allowable UV Exposure Time: Not less than three months.

- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
 - c. Advanced Building Products Inc.; Wind-o-wrap.
 - d. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - e. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
 - f. MFM Building Products Corp.; Window Wrap.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier 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.

END OF SECTION 07 2500

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SECTION 07 3113 - ASPHALT SHINGLES

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. Asphalt shingles.
 - 2. Underlayment.
- B. Related Sections:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood framing.
 - 2. Section 06 1600 "Sheathing" for roof-deck wood structural panels and roof sheathing.
 - 3. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings and flashings.

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain ridge and hip cap shingles from single source from single manufacturer.
- C. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Roofing Corporation.
 - b. CertainTeed Corporation. (Basis of Design is Landmark Pro Series with 40 year limited warranty, 10 year non-prorated warranty period and 15 year 110 mph wind warranty.)
 - c. Elk Premium Building Products, Inc.; an ElkCorp company.
 - d. GAF Materials Corporation.
 - e. Owens Corning.
 - f. TAMKO Roofing Products, Inc.

2. Strip Size: Manufacturer's standard.
 3. Algae Resistance: Granules treated to resist algae discoloration.
 4. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226 or ASTM D 4869, Type II, asphalt-saturated organic felts, nonperforated.
- B. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied.
1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, Inc.
 - b. Grace, W. R. & Co. - Conn.
 - c. Henry Company.
- C. Synthetic Underlayment: ASTM D 226 or ASTM D 4869, perm rating .061, meets ASTM E108-11.

2.3 RIDGE AND EAVE 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 external deflector baffles; for use under ridge shingles.
1. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
 - a. Air Vent, Inc.; a Gibraltar Industries company.
 - b. Cor-A-Vent, Inc.
 - c. GAF Materials Corporation.
 - d. Owens Corning.
 2. Minimum Net Free Area: 18 sq. inch per foot.
 3. Width: 12".
 4. Color: Black.

- B. Combination drip edge/soffit vent: Lomanco SV-10. Color: brown.

2.4 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, smooth 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 OSB or 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.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Aluminum, mill finished.
- 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 the item.
 - 1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 - 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
 - 3. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. 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 felt underlayment 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.
 - 2. Install fasteners at no more than 36 inch o.c.
- C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, 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.
 - 1. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
 - 2. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
 - 3. Valleys: Extend from lowest to highest point 18 inches on each side.
 - 4. Hips: Extend 18 inches on each side.
 - 5. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
 - 6. Sidewalls: Extend beyond sidewall 18 inches, and return vertically against sidewall not less than 4 inches.

7. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating element not less than 4 inches.
8. Roof Slope Transitions: Extend 18 inches on each roof slope.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07 6200 "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."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- E. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- F. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: 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 at least 7 inches wide with self-sealing strip face up at roof edge.
 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
 2. Install starter strip along rake edge.
- 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. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
- E. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.
 - 1. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- F. 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.
- G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07 3113

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SECTION 07 4113.16 - STANDING-SEAM METAL ROOF PANELS

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 standing-seam metal roof panels.
- B. Contractors to include standing-seam metal roof panels as part of Alternate G-1.
 - 1. Remove asphalt shingle roofing as part of Alternate G-1.
- C. Related Sections:
 - 1. Section 07 4213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.
 - 2. Section 07 7253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel 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.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Snap-Lock, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch (0.71 mm).
 - b. Exterior Finish: Three-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Clips: One-piece fixed to accommodate thermal movement.

- a. Material: 0.028-inch-(0.71-mm-)0.064-inch-(1.63-mm-)nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Panel Coverage: 18 inches (457 mm).
5. Panel Height: 1.75 inches (25 mm).
6. Basis-of-Design Product: Subject to compliance with requirements, provide Metal Panel Systems, Inc. – MP-175, 24 GA, striated stiffener pattern or comparable product by the following:
 - a. Dimensional Metals, Inc.
 - b. Peterson Aluminum Corporation

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
- B. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts. Raptor synthetic underlayment or equal is also an acceptable material.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-(25-mm-)thick, flexible

closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 40 foot long-(2400-mm-)long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.
- E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot-(3-m-)long minimum sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal

Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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 same piece are unacceptable. 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.
- C. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface (if required to achieve manufacturer's 20 year water tightness warranty).
 - 2. At a minimum, apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of 36 inches (914 mm) beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (152 mm).

- c. Rake edges for a distance of 18 inches (460 mm).
 - d. Hips and ridges for a distance on each side of 12 inches (305 mm).
 - e. Roof-to-wall intersections for a distance from wall of 18 inches (460 mm).
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).
- B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
 - 1. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 6200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.
- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

- I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- J. Downspouts: Join sections with 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 (1524 mm) o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4113.16

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SECTION 07 4200 - SOLID PHENOLIC EXTERIOR WALL CLADDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Stonewood Panels: Solid phenolic panels for exterior wall cladding of commercial and institutional buildings.

1.2 RELATED SECTIONS

- A. Section 05: "Cold-Formed Metal Framing"
- B. Section 07: "Thermal Insulation"
- C. Section 09: "Gypsum Board"

1.3 REFERENCES

- A. ASTM D638 - 10 Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D790 - 10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- C. ASTM E84 - 12 Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. NEMA Standards Publication LD3-2005. High pressure decorative laminates.
- E. 2012 International Building Code, Chapter 14 Exterior Walls.

1.4 SUBMITTALS

- A. Comply with Section 01 3300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's printed product literature and specifications including fabrication and assembly.
- C. Samples: Submit manufacturer's standard 3"x3" samples of panel cladding materials representative of colors and texture.
- D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with

specified requirements and are suitable for intended application.

- E. Warranty: Submit manufacturer's standard warranty.
- F. Installation Instructions (descriptive manual)
- G. Shop Drawings: Submit complete sets of fabrication/installation drawings including panel dimensions, thickness, location of joints, method of anchorage, number of anchors, supports, accessories, etc.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

- 1. Sufficient plant facilities to provide quality and quantity of materials as required without delaying progress of the work.
- 2. Minimum of 40 years of experience in paper saturation of phenolic resin, and producing phenolic paper laminate.

B. Fabricator:

- 1. Fabricated by the manufacturer, and/or
- 2. Contracted by the customer, minimum 5 years of experience in fabrication work of exterior cladding system for the size and complexity of the projects.
- 3. Approved by the manufacturer.

C. Installer:

- 1. Proven professional cladding system installer with a minimum of 5 years of documented experience.
- 2. Approved by the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original unopened containers/packages, with labels clearly identifying product name, manufacturer, color/texture, and weight.

B. Storage:

- 1. Store materials in clean, dry area in accordance with manufacturer's instructions.
- 2. Keep package sealed until ready for use.

C. Handling:

- 1. Handle materials in accordance with manufacturer's instructions.
- 2. Protect materials during handling to prevent damage.

1.7. WARRANTY

- A. Limited warranty: Fibersin warrants that Stonewood Architectural Panels shall be free from material defects for a period of 10 years. Refer to www.stonewoodpanels.com for details.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Fibersin Industries, Inc., PO Box 808, Oconomowoc, WI 53066. Phone: (262) 567-4427
Fax: (262) 567-4814, Web Site: www.fibersin.com. Email: info@fibersin.com.

2.2 STONEWOOD EXTERIOR ARCHITECTURAL PANELS

- A. Material: Solid phenolic laminate panel with UV protection
- B. Colors/Patterns: Architect to select from manufacturer's full range.
- C. Finish: #60 Matte
- D. Fabricated Sizes: 7 5/8" wide X 8' long; 11 5/8" wide X 8' long
- E. Panel Thickness: 3/8", 10 mm
- F. Panel Core: Standard black

2.3 MINIMUM MATERIAL PROPERTIES

- A. NEMA Requirements:

Description	Test	NEMA Requirements			
Thickness			0.156"	0.250"	0.500"
Resistance to High Temperature	3.6	Slight Effect	No Effect	No Effect	No Effect
Ball Impact Resistance: Inches Drop	3.8	75"	90"+	96"+	96"+
Dimensional Change: Length (Machine Direction)	3.11	0.3% Maximum	0.25%	0.25%	0.25%
Width (Cross Direction)		0.7% Maximum	0.50%	0.50%	0.50%
Weight Per Unit Area					

Lbs/ft ²			1.07	1.71	3.42
Kg/m ²			5.2	8.35	16.7
Density (PCF)			82	82	82

B. Mechanical Properties:

Property	NEMA Requirements	0.156"	0.250"	0.500"
Flexural Strength ASTM D-790				
MD (psi)	18,000	20,000	20,000	20,000
CD (psi)	12,000	16,000	16,000	16,000
Flexural Modulus ASTM D-790				
MD (psi)	1.6x10 ⁶	2.0 x 10 ⁶	2.0 x 10 ⁶	2.0 x 10 ⁶
CD (psi)	1.4x10 ⁶	1.5 x 10 ⁶	1.5 x 10 ⁶	1.5 x 10 ⁶
Tensile Modulus ASTM D-638				
MD (psi)	18,000	18,000	18,000	18,000
CD (psi)	12,000	13,000	13,000	13,000

C. Fire Resistance:

Fire Resistance

Product Type
Class A

	Thickness	0.250"
Flame Spread Index - ASTM E-84 (BLDG)*		15
Smoke Developed Values - ASTM E-84 (BLDG)*		15
Fire Rating* (Standard Product is Class B)		A

* Test Method: ASTM E84-13a - Standard Test Method for Surface Burning Characteristics of Building Materials. Also known as NFPA 255, UL 723, and UBC 8-1.

D. Manufacturing Tolerance:

Thickness (.156 to .375)	+/- .020
Thickness (above .375 to 1.000)	+/- .030
CNC Shaped size (Length -Width)	+/- .020
Drill Diameter	+/- .003
Drill Depth	+/- .020
CNC Hole to Hole	+/- .020
CNC Hole to Edge (1 Oper)	+/- .020
CNC Hole to Edge (2 Oper)	+/- .030
Routing - (Slots Width and Length)	+/- .015
Routing - (Slots Depth)	+/- .020

2.4 ACCESSORIES (FASTENERS)

- A. Manufactured by approved supplier.
- B. Provide exterior wall cladding system designed to withstand the effects of dead load, live load, and accommodate hygrothermal expansion/contraction of the panel.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's/fabricator's/supplier's product data, handling and installation instruction/manual, shop drawings, shipping container/package ticket identification, etc.

3.2. EXAMINATION

- A. Verify correct panels received, including dimension, tolerance, color/texture.
- B. Verify correct attachment system received for the specific project/job.
- C. Verify all the documents, including shop drawings and installation guidelines.
- D. Verify installation conditions are satisfactory to receive work of this Section before the commencement.
- E. Verify substrate installation is complete, flat, and true to plane.

3.3. PREPARATION

- A. Field Measurements: Verify prior to fabrication and installation of the cladding panel.
- B. Protect surrounding areas and surfaces to preclude damage during work of this Section.
- C. Lay out work before beginning installation as necessary for true, plumb, and aligned panel installations.
- D. Verify locations of joints and panel lengths.

3.4. INSTALLATION

- A. Conform to manufacturer's instructions and provisions of shop drawings.
- B. Conform to fastener's instructions for installation of fasteners.

- C. Install to allow hygrothermal expansion/contraction.
- D. Use appropriate techniques/tools to work with the panel.
- E. Do not force to fit, bend, or stretch/compress.
- F. Make cutting and fitting neat, square, and true. Where required, cut, de-burr edges, and clean filings from adjacent surfaces.
- G. Do not install damaged or questionable panels.

3.5. FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide field services to ensure product installation is in accordance with manufacturer's/fabricator's/supplier's instructions and installation manuals, shop drawings, etc.

3.6. ADJUSTING

- A. Correct identified defects and irregularities.
- B. Replace damaged, soiled, and discolored work.

3.7. CLEANING

- A. Leave installation clean and free from residue and debris from work of this Section.

END OF SECTION 07 4200

SECTION 07 4213.53 - METAL SOFFIT PANELS

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 metal soffit panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Shop drawings to be prepared by the manufacturer.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency that meets or exceeds minimum standards.
- C. Field quality-control reports.

- D. Sample Warranties: For special warranties.
- E. Manufacturer weekly inspection report.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Material Manufacturer will provide minimum two days a week job inspections during installation and weekly progress reports.
- B. Manufacturer must have minimum 20 years of experience in metal roofing.
- C. All roofing, wall panels and soffits are to be from one manufacturer with one system warranty.
- D. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with no less than 10 years experience with the roofing system specified and no less than 5 roofs of similar scope.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.

- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. The Garland Co.
 - b. Tremco
 - c. CENTRIA
 - d. BEMO
 - e. Merchant & Evans Inc.
 - f. Dimensional Metals Inc. (DMI)
 - g. Peterson Aluminum Corporation
 - 2. Material: .032 aluminum.
 - 3. Panel Coverage: 12 inches.
 - 4. Panel Height: 0.438 inch.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a stripable, temporary protective covering before shipping.
- B. 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 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, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4213.53

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

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. Formed wall sheet metal fabrications.

- B. Related Requirements:

- 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 07 3113 "Asphalt Shingles " for materials and installation of sheet metal flashing and trim integral with roofing.
 - 3. Section 07 7100 "Roof Specialties" for roof edge draining systems.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested and FM Approvals approved.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including gutter, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. FM Approvals Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- E. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 - 1. Nonpatinated Exposed Finish: Mill.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
- C. Solder:
 - 1. For Copper: ASTM B 32, with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polysulfide polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry,

metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Copper: 16 oz./sq. ft. (0.55 mm thick).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.

- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder aluminum sheet.
 - 2. Do not use torches for soldering.
 - 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 4. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.

3.3 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

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SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof-edge drainage systems.

- B. Related Requirements:

- 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 07 4213.53 "Metal Soffit Panels."
 - 3. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 4. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

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

- 1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Selection: For each type of roof specialty indicated with factory-applied color finishes.

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include roof-edge drainage systems made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including fascia gutter and downspout, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace 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 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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 calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Architectural Products Company.
 - 2. ATAS International, Inc.
 - 3. Drexel Metals.
 - 4. Hickman Company, W. P.
 - 5. Metal-Era, Inc.
 - 6. Perimeter Systems; a division of SAF.
 - 7. Peterson Aluminum Corporation
- B. Gutters: Manufactured in uniform section lengths not exceeding 50 feet (40 feet minimum lengths), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Aluminum Sheet: 0.040 inch (1.02 mm) thick.

2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
 3. Size: 6" Standard
 4. Corners: Factory mitered and continuously welded.
 5. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
 6. Gutter Accessories: Continuous screened leaf guard with sheet metal frame, flat ends.
- C. Downspouts: Plain rectangular complete with smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.040 inch (1.02 mm) thick.
 2. Size: 4" x 6"
 3. Downspout connector to be Piedmont Downspout Adapter Model "SO" with integral cleanout. Color to be selected by architect from manufacturer's full standard range.

2.3 MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 1. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

2.5 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: 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.
- D. Coil-Coated Aluminum Sheet Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- E. Aluminum Extrusion Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

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 the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Mitered and fully welded corners, end caps, and transitions. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 40 feet (15.2 m) apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - 1. Connect downspouts to underground drainage system indicated. Downspout boot connector to be Piedmont Manufacturing downspout adapter model 'SO' with polyester powder coat finish. Color: P004-BR23.

3.4 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 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 roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

SECTION 07 7253 - SNOW GUARDS

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. Rail-type, seam-mounted snow guards. Contractors to include 215 lineal feet of snow guards in their bid for Alternate G-1.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
 - 1. Include details of rail-type snow guards.
 - 2. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.
- C. Samples: Full-size unit Base, bracket, and 12-inch- long rail.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Structural Performance:
 1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

A. Seam-Mounted, Rail-Type Snow Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Basis of design: Metal Roof Innovations, Ltd.: S-5! Attachment Solutions (ColorGard with S-5-N bracket). Coordinate appropriate aluminum mechanical attachment bracket style with standing seam roof rib depth and profile.
 - b. Alpine SnowGuards; a division of Vermont Slate & Copper Services, Inc.
2. Last option in "Description" Subparagraph below corresponds with proprietary "ColorGard" system by Metal Roof Innovations and is licensed through some other manufacturers.
3. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with one rail with color-matching inserts of material and finish used for metal roofing.
4. Material and Finish: Aluminum; clear anodized with metal insert to match roof color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
 1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates for bonding snow guards.
- B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions.
- B. Attachment for Standing-Seam Metal Roofing:
 - 1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
 - 2. Seam-Mounted, Rail-Type Snow Guards: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels. Install per manufacturer's instructions.

END OF SECTION 07 7253

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SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Polysulfide joint sealants.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.
- B. Related Sections:
 - 1. Section 04 2200 "Concrete Unit Masonry" and 04 4313 "Anchored Brick and Stone Masonry Veneer" for masonry control and expansion joint fillers and gaskets.
 - 2. Section 08 8000 "Glazing" for glazing sealants.
 - 3. Section 09 2900 "Gypsum Board" for sealing perimeter joints.
 - 4. Section 09 3100 "Tiling" for sealing tile joints.
 - 5. Section 09 5113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 POLYURETHANE JOINT SEALANTS

- A. Multicomponent, Nonsag, Polyurethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Tremco Dymeric 240 FC.
 - 1) Colors:
 - For cast stone: Van Dyke
 - For brick: River Red Rouge
 - For storefronts and windows: Dark Bronze

2.3 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 600.
 - b. Pecora Corporation; AC-20+.

- c. Tremco Incorporated; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

- 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Pecora Corporation; AC-20 FTR.
- b. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 Flexible Firestop Sealant: Manufacturer's red, nonsag acrylic based sealant complying with ASTM E814, ASTM E84, UL2079, UL1479, ASTM E1966 and ASTM G21.

- 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Hilti, Inc.: CP 606 or approved equal.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.7 MISCELLANEOUS MATERIALS

- A. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
- B. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, 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.

3.4 FIELD QUALITY CONTROL

- A. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

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SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

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. Standard and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

- 1. Division 04 Section "Concrete Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 08 Section "Flush Wood Doors."
 - 3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 - 4. Division 08 Section "Door Hardware."
 - 5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

- B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: 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 (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within one year after substantial completion.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CECO Door Products.
 - 2. Curries Company.
 - 3. Mesker Door Group.
 - 4. Steelcraft.
 - 5. Republic.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 - 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 - 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
 - 1. CECO Door Products Legion Series.
 - 2. Curries Company 707 Series.

3. Mesker Door Group N Series.
 4. Republic DE series Door.
 5. Steelcraft L series Door.
- E. Interior Tornado Resistant Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polyurethane core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 6. Doors to meet ICC500 – 2014 and FEMA 361-2015, for 250- mph zone.
 7. Manufacturers Basis of Design:
 - a. CECO Door Products Stormpro series.
 - b. Curries Company Stormpro series.
 - c. Steelcraft Paladin Series.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 4. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 12 gauge (0.081-inch -2.7-mm) thick steel sheet.
 5. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 - 3. Frames for Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 4. Frames for openings up to 48 inches in width: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.]
 - 5. Frames for openings 48 inches and wider in width: Minimum 14 gauge (0.067-inch - 1.7-mm) thick steel sheet.]
 - 6. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
 - 7. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
- D. Manufacturers Basis of Design:
 - a. CECO Door Products SQ/SU/SR Series (Masonry Profile).
 - b. Curries Company M/G Series (Masonry Profile).
 - c. Mesker F Series (Masonry Profile).
 - d. Republic M Series (Masonry Profile).
 - e. Steelcraft F Series (Masonry Profile).
- E. Interior Tornado Resistant Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 - 3. Frames for Steel Doors: Minimum 14 gauge thick steel sheet.
 - 4. Frames to meet ICC500 – 2014 and FEMA 361-2015, for 250- mph zone.
- F. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- G. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.
- H. Manufacturers Basis of Design:
 - a. CECO Door Products Stormpro series.
 - b. Curries Company Stormpro series.
 - c. Steelcraft Paladin Series.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
4. Windstorm Opening Anchors: Types as tested and required for indicated wall types to meet specified wind load design criteria.
5. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.8 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.
 - 1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 1113

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SECTION 08 1416 - 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.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Sections:

- 1. Division 08 Section "Hollow Metal Doors and Frames" for wood doors in steel frames.
 - 2. Division 08 Section "Glazing" for glass view panels in wood doors.
 - 3. Division 08 Section "Door Hardware" for door hardware for flush wood doors and wood frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.6 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.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: 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 (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) 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. Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
 2. Eggers Industries.
 3. Marshfield (Masonite Company)
 4. Oshkosh Door Company.
- a. Door Type: Select White Birch, plain sliced.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWT's, AWMAC's, and WT's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

- B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

- C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade Aa faces.
2. Species: Red Oak.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Particleboard.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 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. 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.
 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
- D. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
- E. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
1. Grade: Premium.
 2. Finish: AWT's, AWMAC's, and WT's "Architectural Woodwork Standards" System 5, conversion varnish.
 3. Stain color: to be selected by architect from manufacturer's full range.
 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed 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 Section 08 7100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

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 1416

SECTION 08 3613 - SECTIONAL 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 electrically operated sectional doors.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.
- C. Windborne-Debris Impact Resistance: Provide glazed sectional doors that pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for project site location.
- D. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 DOOR ASSEMBLY TYPE OH 1

- A. Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide wide frame and/or heavy duty products by one of the following:
 - a. C.H.I. Overhead Doors (3295).
 - b. Clopay Building Products (900 Series).
 - c. Wayne-Dalton Corp. (Model 452).
 - d. Overhead Door (Model 521).
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

- C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283 or DASMA 105.
- D. Installed R-Value: 4.5 deg F x h x sq. ft./Btu.
- E. Aluminum Sections: Extrusions: ASTM B221, 6063-T5 or T6 alloy and temper.
 - 1. Section Thickness: 1³/₄ - 2 inches.
 - 2. Exterior-Face, Aluminum Sheet Thickness: 16 gage nominal coated thickness.
 - a. Surface: Flat.
 - 3. Infill panels: aluminum, finished to match door frame.
 - 4. Interior Facing Material: Aluminum sheet with a nominal coated thickness of 16 gage.
- F. Track Configuration: Standard lift track, follow the roof.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- H. Windows: Refer to the drawings for configuration.
 - 1. Glazing: tempered insulating glass.
- I. Counterbalance Type: Torsion spring.
- J. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
 - 2. Operator Type: Jackshaft, side mounted.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
 - 4. Motor Exposure: Interior, clean, and dry.
 - 5. Emergency Manual Operation: Chain type.
 - 6. Obstruction-Detection Device: Automatic photoelectric sensor and electric sensor edge on bottom section.
 - a. Sensor Edge Bulb Color: Black.
 - 7. Control Station: Where indicated on Drawings.
 - 8. Other Equipment: Portable, radio-control system.
 - 9. Gate Arms: 10' LED red/green light strips with integrated LED controller and mounting hardware. www.gatearms.com.

10. Provide a door position switch on each track/operator for the purposes of sending a signal to the apparatus ignition activated bay exhaust system.

K. Door Finish:

1. Aluminum Finish: Clear Anodized.

2.4 MATERIALS, GENERAL

- 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.

2.5 ALUMINUM DOOR SECTIONS

- A. Exterior Section Faces and Frames: Extruded aluminum.
- B. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- C. Provide reinforcement for hardware attachment.
- D. Interior Facing Material: Aluminum sheet, complying with ASTM A 653/A 653M, with indicated thickness. Non-view panels shall be 1/2" minimum with expanded polystyrene insulation.
- E. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, 3" galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
 1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 zinc coating.
 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
 3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

- a. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members (follow the roof line).
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
- C. Windows: Manufacturer's standard window units of type, size, and in arrangement indicated. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors. Provide removable stops of same material as door-section frames.

2.7 HARDWARE

- A. General: 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 of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track.
- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
 - a. Liftmaster, Model GH or equal by The Chamberlain Group.
 - b. RSX Commercial Operator.
 - 2. Comply with NFPA 70.
 - 3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
 - 1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics: Refer to Drawings.
 - 2. Motor Size: As recommended by manufacturer, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - a. Provide aux input/output module, timer close module and monitored door edge module.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
5. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction such as Miller Edge wireless through-beam NEMA 4X.
 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Portable, Radio-Control System: Consisting of the following:
 1. Three-channel universal coaxial receiver to open, close, and stop door.

2. Provide one unit per door.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 3613

SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior and interior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior and interior manual-swing entrance doors

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Produced by the Manufacturer and specific to this project.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 3. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data: For Installer and laboratory mockup testing agency and field testing agency.
- C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.

- H. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. 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.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
- 1. 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Structural Loads:
- 1. Wind Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $1/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch (19.1 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch (3.2 mm), whichever is smaller.
 - a. Operable Units: Provide a minimum $1/16$ -inch (1.6-mm) clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than $1/240$ of clear span plus $1/4$ inch (6.35 mm) for spans greater than 11 feet 8- $1/4$ inches (3.6 m) or $1/175$ times span, for spans less than 11 feet 8- $1/4$ inches (3.6 m).
- D. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 0.6.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
 2. Maximum Water Leakage: According to AAMA 501.1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
- J. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
 2. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
- K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis of Design Product: Refer to the Window Schedule on drawing sheet A0.03 for basis of design specific models for components. Subject to compliance with requirements, provide Kawneer 451T for storefronts, entrances and windows, or comparable products that meet or exceed basis of design products by one of the following:

1. EFCO Corporation
 2. Vistawall
 3. Tubelite Inc.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing venting windows and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
 4. Finish: High-performance organic finish.
 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 FIXED AND VENTING WINDOWS

- A. Aluminum Windows: Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
1. Window Type: Fixed and awning.
 2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch (1.63-mm) thickness at any location for main frame and sash members.
 - a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 3. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
 4. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 - a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch (3.26 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
 5. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - a. Cam-action sweep sash lock and keeper at meeting rails.
 - b. Spring-loaded, snap-type lock at jambs.
 - c. Pole-operated, cam-action locking device on meeting rail where rail is more than 72 inches (1830 mm) above floor.
 - d. Lift handles for single-hung units.
 - e. Nylon sash rollers for horizontal-sliding units.
 - f. Steel or bronze operating arms.
 6. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.
 7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
 - a. Fabric: Manufacturer's standard glass-fiber mesh fabric.

- B. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.
- C. Finish: Match adjacent aluminum-framed entrances and storefront finish.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Wide stile; 5-inch (127-mm) nominal width. Basis of Design: Kawneer Insulclad 560.
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware is specified in Section 08 7100 "Door Hardware."

2.7 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: Comply with Section 08 8000 "Glazing."
- D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: Black.

- E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

- 1. Color: Match structural sealant.

2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using screw-spline system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, or thicker.

2.11 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 9200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 08 8000 "Glazing."
- G. Install weatherseal sealant according to Section 07 9200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 MAINTENANCE SERVICE

- A. Entrance Door Hardware:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 4113

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SECTION 08 7100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware and power supplies.
- C. Related Sections:
 - 1. Division 08 Section “Hollow Metal Doors and Frames”.
 - 2. Division 08 Section “Flush Wood Doors”.
 - 3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
 - 4. Division 28 Section “Access Control”.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
 - 1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
 - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
 - 3. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Thresholds: Not more than 1/2 inch high.
 - 4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

- a. Test Pressure: Positive pressure labeling.
- F. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to FEMA 361, Second Edition (2014), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
1. Ten years for extra heavy duty cylindrical (bored) locks and latches.
 2. Ten years for exit hardware.
 3. Twenty five years for manual surface door closers.
 4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

2. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

- a. Permanent cylinders, cores, and keys to be installed by Owner.

- B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

- a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. For door widths up to 3'0": Provide 4-1/2" standard or heavy weight as specified.
 - b. For door widths from 3'1" to 4'0": Provide 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

- a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

- a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

- 1) Out-swinging exterior doors.
- 2) Out-swinging access controlled doors.
- 3) Out-swinging lockable doors.

5. Acceptable Manufacturers:

- a. Bommer Industries (BO).
- b. Hager Companies (HA).
- c. McKinney Products (MC).
- d. Stanley Hardware (ST).

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

- a. Bommer Industries (BO).
- b. Hager Companies (HA).
- c. McKinney Products (MC).
- d. Pemko Manufacturing (PE).
- e. Stanley Hardware (ST).

2.3 POWER TRANSFER DEVICES

- A. Concealed Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets.

1. Acceptable Manufacturers:

- a. ABH Manufacturing (AB) PT1000.
- b. Securitron (SU) - CEPT Series.
- c. Von Duprin (VD) - EPT-10 Series.

2.4 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - a. Acceptable Manufacturers:
 - 1) Door Controls International (DC).
 - 2) Hager (HA).
 - 3) Hiawatha, Inc. (HI).
 - 4) Rockwood Manufacturing (RO).
 - 5) Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: None
 - 1. Bonded Lock Service
3224 Dixie Hwy
Erlanger, KY 41018
859-341-4474

Facility standard.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 5. Keyway: Match Facility Patented Keyway.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Interchangeable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide interchangeable core (small format) as specified in Hardware Sets.
- E. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patented security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.
1. Acceptable Manufacturers:
 - a. Medeco (ME) – X4 FJ99
Facility Standard.
- F. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
- G. Key Quantity: Provide the following minimum number of keys:
1. Top Master Key: One (1)
 2. Change Keys per Cylinder: Two (2)
 3. Master Keys (per Master Key Group): Two (2)
 4. Grand Master Keys (per Grand Master Key Group): Two (2)
 5. Construction Keys (where required): Ten (10)
 6. Construction Control Keys (where required): Two (2)
 7. Permanent Control Keys (where required): Two (2)
- H. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".
- I. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

- J. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Acceptable Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).
- K. Key Control Software: Provide one network version of "Key Track" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Track" software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Multi-Point Locksets, Security: Three-point locking system device engineered for in-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked.
 - 1. Severe Storm Shelter Components: Multi-point locking system devices engineered for in-swinging and out-swinging door applications on tornado or hurricane resistant safe shelter rooms. The multi-point latching integrated device is approved for usage as part of a complete ICC 500 (2014) and FEMA 361 door, frame and hardware assembly. Ability to resist 15lb 2x4 100 mph, for wind speeds up to 250mph.
 - 2. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - FE6600 Series.
 - b. Sargent Manufacturing (SA) - FM7300 Series.
 - c. Schlage (SC)
- B. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.
 - 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – ML2000 Series.

- b. Sargent Manufacturing (SA) – 8200 Series.
 - c. Schlage (SC) – L9000 Series.
 - d. Stanley Best (BE) – 45H Series.
- C. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.
 - 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series
 - b. Sargent Manufacturing (SA) – 10 Line.
 - c. Schlage (SC) – ND Series.
 - d. Stanley Best (BE) – 9K3 Series.
- D. Lock Trim Design: As specified in Hardware Sets.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Narrow Stile Interconnected Locksets: Interconnected locksets designed with a mortise case which contains both a latchbolt and deadbolt and allows simultaneous retraction of both the latchbolt and deadbolt with a single motion turning of the lever handle. Locksets to be non-handed and available with a 1 1/8" or 1 1/2" standard backset. Latchbolt and deadbolt shall be fabricated of wrought brass and bronze with a minimum 3/4" latchbolt throw and 1" deadbolt throw. Electromechanical options include solenoid activated outside trim.
 - 1. Acceptable Manufacturers:
 - a. Adams Rite (AD) – 4300 Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Dustproof Strikes: BHMA A156.16.

2.9 ELECTROMAGNETIC LOCKING DEVICES

- A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 1 with minimum holding force strength of 1,200 pounds. Locks to be capable of either 12 or 24 voltage and be UL listed for use on fire rated door assemblies. Electronics are to be fully sealed against tampering and allow exterior weatherproof applications. As indicated in Hardware Sets, provide specified mounting brackets and housings. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Acceptable Manufacturers:
 - a. Security Door Controls (SD) – EMLock 1500 Series.
 - b. Securitron (SN) – M62 Series.

2.10 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 1500 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Acceptable Manufacturers:
 - a. Dorma (DM)
 - b. Folger Adam EDC (FO).
 - c. HES (HS).
 - d. Trine (TR)
 - e. Von Duprin (VO).

- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.11 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
 - b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.
 6. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 11. Hurricane and Tornado Resistance Compliance: Conventional exit devices and tube steel removable mullions to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Detex (DE) – Advantex Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Stanley Precision (PH) - Apex Series
 - d. Von Duprin (VD) - 99 Series.

2.12 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES

- A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below.
1. Acceptable Manufacturers:
 - a. Detex (DE) – Advantex Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Stanley Precision (PH) - Apex Series
 - d. Von Duprin (VD) - 99 Series.
 - B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction (must be motorized type that fully retracts the touchpad/push bar), electric dogging, outside door trim control, exit alarm, delayed egress, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as fail secure.

2.13 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 10 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
 - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
 - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
 - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
 6. Closer Covers: Provide PVC free closer covers with a painted finish to match other hardware on the project.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
 8. For doors with integral stop, provide separate concealed overhead stop, if door closer manufacturer doesn't offer integral stop with the door closer.

9. Hurricane and Tornado Resistance Compliance: Door closers to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. LCN Closers (LC) - 4040XP Series.
 - c. Sargent Manufacturing (SA) - 351 Series.
 - d. Stanley Ryobi (RY) – D4550 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
 - a. Stainless Steel: .050-inch thick, with countersunk screw holes (CSK).
4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:

- a. Hager (HA).
- b. Hiawatha, Inc. (HI).
- c. Rockwood Manufacturing (RO).
- d. Trimco (TC).

2.15 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Acceptable Manufacturers:
 - a. Hager (HA).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood Manufacturing (RO).
 - d. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Acceptable Manufacturers:
 - a. Dorma (DM).
 - b. Glynn-Johnson (GJ).
 - c. Rixson Door Controls (RF).
 - d. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 - 1. Hager (HA).
 - 2. National Guard Products (NG).
 - 3. Pemko Manufacturing (PE).
 - 4. Zero International (ZE).

2.17 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – 3280 Series.
 - b. Securitron (SU) - DPS Series.
- B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

- a. Corbin Russwin Hardware (RU) – 781N.
- b. Dorma (DM) – PS Series.
- c. Sargent Manufacturing (SA) – 3500 Series.
- d. Securitron (SU) - BPS Series.
- e. Von Duprin (VO) - PS.

2.18 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
 - 2. Locks: Install only curved lip strikes and a dust box behind each strike.
 - 3. Exit Devices: For doors with continuous hinges, locate power transfers in door and frame centered on exit devices.
 - 4. Closers: Install closer to permit maximum degree of door swing allowed by job conditions.
 - a. Fasteners:
 - 1) Wood doors with particle board core, use fully threaded steel screws with 1-1/2" minimum penetration into door. Do not use self-tapping fasteners on plastic faced doors.
 - 2) Mineral core wood doors, use through bolts.
 - 3) Metal doors, use steel machine screws.
 - 5. Door stops:
 - a. Located floor stops so as not to create a tripping hazard, and to catch door at point 6 inches in from latch edge, but in no case further than 1/3 door width measured from door hinge edge.
 - b. Locate projecting wall stops 9 inches above finished floor with sloped edge on top.
 - c. Wall stops intended for knobs and levers are to be located centered on spindle. Do not install stops having concave bumpers when convex bumpers are scheduled.
 - 6. Door plates (Armor, Kick and Mop plates):
 - a. Armor and kick plates: Install on the push side of single acting doors and on both sides of double egress doors.
 - b. Mop plates: Install on pull side of single acting doors.
 - c. Mount bottom of threshold 1/4 inch above door bottom.
 - 7. Thresholds:

- a. Scribe and cut to fit profiles of door jambs with mitered corners and precision made joints.
 - b. Provide mitered returns for threshold extending beyond frame face; align miter with frame return.
 - c. File burrs smooth.
 - d. At exterior doors and elsewhere as indicated, set thresholds in bed of butyl rubber sealant; completely fill voids to exclude moisture taking care not to plug drainage holes or block weeps. Remove excess sealant.
 - e. At exterior doors, install bevel of threshold aligned with exterior face of door, unless indicated otherwise in detail or threshold manufacturer's instructions.
 - f. Do not install thresholds over any finish material, unless material is noncombustible; such as ceramic tile, terrazzo or concrete.
 - g. Remove existing floor covering materials to insure threshold is installed directly against a noncombustible substrate.
8. Watherstripping (Seals & Gaskets):
 - a. Install per manufacturers' instructions.
 - b. Do not cut or interrupt extrusions for weatherstripping, seals or gaskets for a door closer accessory, i.e. soffit shoe.
 - c. Contact hardware supplier when a conflict arises for alternate method of attachment, including templates, and obtain approval from Architect prior to installation.
9. Miscellaneous Hardware:
 - a. Push/Pull Sets: Center push/pull sets on door stiles unless noted otherwise on plans. Mount push bar centered 42 inches above finished floor. Top pull to be mounted above push bar. Use only spanner wrench fasteners at back to back mounting points and spanner caps for single through glass mounting points.
 - b. Pull Plates: Install through door-mounted fasteners for pulls flush with face of door. Fasteners for plates with pulls are not to penetrate through opposite side of door.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

5. Mount overlap astragals to protect the latchbolt from the locked side. For inswing doors, mount the astragal to the inactive door leaf. For outswing doors, mount the astragal to the active door leaf.
 6. For outswing exterior doors with parallel arm door closer mount, install head weather strip first, before mounting the door closer. Door closer soffit shoe will mount to the head weather strip and not the frame. This will move the door closer down slightly.
 7. For push pull bar set, mount horizontal push bar at 42 inches above the floor. Mount bottom of pull to common end of the push bar.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
 - 1. AC – Accurate Lock
 - 2. AD - Adams Rite
 - 3. BE – Best
 - 4. BL – Bonded Lock Service
 - 5. DM – Dorma
 - 6. HA – Hager
 - 7. HS – HES
 - 8. ME – Medeco
 - 9. MC – McKinney
 - 10. PE – Pemko
 - 11. PH - Precision
 - 12. RF – Rixson Firemark
 - 13. RO – Rockwood
 - 14. RU – Corbin Russwin
 - 15. SN – Securitron
 - 16. ST – Stanley

3.9

Set: 01			07.68.360	
Doors: 01				
Description: Wide stile aluminum door (with magnetic lock for lockdown) with push pull bar set. Hardware this set to be furnished by storefront contractor.				
3	Hinges (std weight)	BB1191	32D	HA
1	Mortise Cylinder	1E-74	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Magnetic Lock	M62	32D	SN
1	Magnetic Lock accessories	Header extension HEB-1CL-8, Stop filler plate SFP-1/2CL-8, Aluminum spacer bracket ASB-62CL	CLR	SN
1	Push Pull bar set (45 degree pull, 12” center to center)	47 with BF168 T1 type mounting	US32D	RO
1	Surface Door Closer (top jamb)	D-4551 Std P45-180	689	ST
1	Concealed Overhead Stop	#1 series stop	630	RF
1	Power Supply	BPS-24-1		SN
1	Keyswitch (reset)	MKA		SN
1	Relay logic pack	RLP-24		SN
1	Duress push button (initiate)	PB4L-2	32D	SN
1	Wiring diagram	WD-P2P		RU
1	Rain drip	346C TEK		PE
1	Threshold	2005 AT FHSL25	MIL	PE
1	Weatherstripping	By aluminum door supplier		
1	Door Sweep	By aluminum door supplier (integral part of the door)		
Provide required magnetic lock accessories for frame profile.				

Set: 02			05.46.360	
Doors: 06, 08B				
Description: Wide stile aluminum door with electric exit device, lever trim. Hardware this set to be furnished by storefront contractor.				
1	Continuous Hinge	780-112HD EPT	CLR	HA
1	Exit Device Rim (lever trim, electric)	9700 MLR ZY08 T	630	DM
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Surface Door Closer (top jamb)	D-4551 Std P45-180	689	ST
1	Concealed Overhead Stop	#1 series stop	630	RF
1	Card Reader	By card reader supplier		
1	Power Transfer	CEPT-10		SN
1	Power Supply	PS532RF		DM
1	Wiring diagram	WD-P2P		RU
1	Rain drip	346C TEK		PE
1	Threshold	2005 AT FHSL25	MIL	PE
1	Weatherstripping	By aluminum door supplier		

1	Door Sweep	By aluminum door supplier (integral part of the door)		
One power supply for doors 06 and 08B.				

Set: 03			08.67.360	
Doors: C1				
Description: Wide stile aluminum door with electric deadlatch and push pull bar set. Hardware this set to be furnished by storefront contractor.				
3	Hinges (std weight)	BB1191	32D	HA
1	Electric Deadlatch	4300 1-1/2" backset	628	AD
1	Deadlatch Paddle	4590	US26D	AD
1	Mortise Cylinder	1E-74	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Pull (45 degree pull, 12" center to center)	BF168 T1 type mounting	US32D	RO
1	Surface Door Closer (top jamb)	D-4551 Std P45-180	689	ST
1	Concealed Overhead Stop	#1 series stop	630	RF
1	Card Reader	By card reader supplier		
1	Call system	By call system supplier		
1	Power Transfer	CEPT-10		SN
1	Power Supply	BPS-24-1		SN
1	Wiring diagram	WD-P2P		RU
1	Silencers/Weather strip	By aluminum door supplier		

Set: 04			15.76.241	
Doors: 23C, C3B				
Description: Exterior door with Panic Hardware (electrified latch retraction), pull trim with cylinder.				
1	Continuous Hinge	780-112HD EPT	628	HA
1	Exit Device rim (nightlatch)	MLR 2103 1703A	630	PH
1	Rim cylinder	12E-72	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Surface Door Closer (parallel with stop arm)	D-4551 S	689	ST
1	Kick plate	190S 10” high B4E CSK	US32D	HA
1	Card Reader	By card reader supplier		
1	Power Supply	RPSMLR2		PH
1	Door position switch	DPS-M-GY		SN
1	Power Transfer	CEPT-10		SN
1	Rain drip	346C TEK		PE
1	Threshold	2005 AT FHSL25	MIL	PE
1	Head weather strip	2891 APK		PE
2	Jamb weather strip	45041 CNB TEK		PE
1	Door Sweep	345 ANB TEK		PE
Note to Architect – Card reader system provided in section 281300 or with the door hardware.				

Set: 05				17.70.241
Doors: 28, 29, 30, B1, B3				
Description: Exterior hollow metal door with electric strike and storeroom lockset.				
3	Hinges (hvy wt)	BB1199 NRP	32D	HA
1	Lockset (Storeroom)	45H 7D 15H	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Electric Strike	1006 CLB	630	HS
1	Surface Door Closer (parallel with stop arm)	D-4551 S	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
1	Latch protector	345D	US32D	HA
1	Card Reader	By card reader supplier		
1	Power Supply	PS610RF		DM
1	Door position switch	DPS-M-GY		SN
1	Rain drip	346C TEK		PE
1	Threshold	2005 AT FHSL25	MIL	PE
1	Head weather strip	2891 APK		PE
2	Jamb weather strip	45041 CNB TEK		PE
1	Door Sweep	345 ANB TEK		PE

Set: 06				37.03.060
Doors: 19				
Description: Wide stile aluminum door with privacy set. Hardware this set to be furnished by storefront contractor.				
3	Hinges (std wt)	BB1279	26D	HA
1	Privacy latchset	9K3 0L 15D S3	626	BE
1	Concealed Overhead Stop	#2 series stop	630	RF
1	Silencer / Weatherstrip	By aluminum door supplier		

Set: 07				42.02.00MFB
Doors: M02				
Description: Pair of doors with passage set and flush bolts.				
6	Hinges (std wt)	BB1279	26D	HA
2	Manual Flush Bolts (HMD)	282D	US26D	HA
1	Lockset (passage)	9K3 0N 15D S3	626	BE
2	Wall Stop	230W	US26D	HA
1	Dust Proof Strike	280X	US26D	HA
1	Overlapping astragal	by hollow metal door manufacturer		
2	Silencers	307D		HA

Set: 08				45.20.1/204
Doors: 23A, C3A				
Description: Panic hardware, passage lever trim				
1	Continuous Hinge	780-112HD	CLR	HA
1	Exit Device (passage lever)	2114 4914A	630	PH
1	Surface Door Closer (regular or parallel arm)	D-4551 Std / Std w/PA	689	ST
1	Armor plate	190S 35" high B4E CSK	US32D	HA
1	Wall Stop	230W	US26D	HA
3	Sound seal	S773D		PE

Set: 09				45.46.20A
Doors: 23B				
Description: Panic hardware, lever trim, electrified to work with card reader.				
1	Continuous Hinge	780-112HD	CLR	HA
1	Exit Device (lever, electric latch retraction)	MLR 2108 4908A	630	PH
1	Rim cylinder	12E-72	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Surface Door Closer (parallel arm)	D-4551 Std w/PA	689	ST
1	Armor plate	190S 35" high B4E CSK	US32D	HA
1	Wall Stop	230W	US26D	HA
1	Power Transfer	CEPT-10	32D	SN
1	Power Supply	RPSMLR2		PH
1	Card Reader	by others		
1	Threshold (1/4 inch high)	270A FHSL25	MIL	PE
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Door Sweep	18100 ANB TEK		PE

Set: 10				45.46.24A
Doors: C2B				
Description: Panic hardware, lever trim, electrified to work with card reader.				
1	Continuous Hinge	780-112HD	CLR	HA
1	Exit Device (lever, electric latch retraction)	MLR 2108 4908A	630	PH
1	Rim cylinder	12E-72	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Surface Door Closer (parallel arm)	D-4551 Std w/PA	689	ST
1	Armor plate	190S 35" high B4E CSK	US32D	HA
1	Wall Stop	230W	US26D	HA
1	Power Transfer	CEPT-10	32D	SN

1	Power Supply	RPSMLR2		PH
1	Card Reader	by others		
1	Threshold (1/4 inch high)	270A FHSL25	MIL	PE
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Door Sweep	18100 ANB TEK		PE

Set: 11			47.00.1/201	
Doors: 08A, 16				
Description: Push and pull plates.				
3	Hinges (std wt)	BB1279	26D	HA
1	Push plate	30S 6'' x 16''	US32D	HA
1	Pull plate	31G 4'' x 16''	US32D	HA
1	Surface Door Closer (regular or parallel arm)	D-4551 Std / Std w/PA	689	ST
1	Kick plate	190S 10'' high B4E CSK	US32D	HA
1	Wall Stop	234W	US26D	HA
3	Silencers	307D		HA
Counter sink pull through bolts under the push plate.				

Set: 12			47.00.101	
Doors: 04				
Description: Push and pull plates.				
3	Hinges (std wt)	BB1279	26D	HA
1	Push plate	30S 6" x 16"	US32D	HA
1	Pull plate	31G 4" x 16"	US32D	HA
1	Surface Door Closer (regular arm)	D-4551 Std	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
3	Silencers	307D		HA
Counter sink pull through bolts under the push plate.				

Set: 13			47.03.000	
Doors: 02				
Description: Privacy set.				
3	Hinges (std wt)	BB1279	26D	HA
1	Latchset (privacy)	9K3 0L 15D S3	626	BE
1	Wall Stop	230W	US26D	HA
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Automatic door bottom	430 CMRL (DW) semi-mortise		PE
Use 430 CMRL semi-mortise door bottom with WDD, requires door to be notched.				

Set: 14				
Doors: C2A				
Description: Panic hardware, lever trim, electrified to work with card reader.				
1	Continuous Hinge	780-112HD	CLR	HA
1	Exit Device (lever, electric latch retraction)	MLR 2108 4908A	630	PH
1	Rim cylinder	12E-72	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Surface Door Closer (parallel arm)	D-4551 Std w/PA	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
1	Wall Stop	230W	US26D	HA
1	Power Transfer	CEPT-10	32D	SN
1	Power Supply	RPSMLR2		PH
1	Card Reader	by others		
3	Silencers	307D		HA

Set: 15					47.03.082
Doors: 03, 17, 18					
Description: Privacy set.					
3	Hinges (std wt)	BB1279	26D	HA	
1	Latchset (privacy)	9K3 0L 15D S3	626	BE	
1	Mop plate	190S 4" high B4E CSK	US32D	HA	
1	Wall stop	234W (door 17)	US26D	HA	
1	Surface overhead stop (pull side mount)	#10 series stop with 5258 bracket (doors 03 and 08)	630	RF	
3	Silencers	307D		HA	

Set: 16					47.03.103
Doors: 21					
Description: Privacy set.					
3	Hinges (std wt)	BB1279	26D	HA	
1	Latchset (privacy)	9K3 0L 15D S3	626	BE	
1	Surface Door Closer (regular arm)	D-4551 Std	689	ST	
1	Kick plate	190S 10" high B4E CSK	US32D	HA	
1	Mop plate	190S 4" high B4E CSK	US32D	HA	
1	Wall Stop	234W	US26D	HA	
3	Silencers	307D		HA	

Set: 17				47.03.10N
Doors: 11, 12, 13, 14, 15, 20				
Description: Privacy set.				
3	Hinges (std wt)	BB1279	26D	HA
1	Latchset (privacy)	9K3 0L 15D S3	626	BE
1	Surface Door Closer (regular arm)	D-4551 Std	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
1	Wall Stop	234W	US26D	HA
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Automatic door bottom	430 CMRL (DW) semi-mortise		PE
<i>Use 430 CMRL semi-mortise door bottom with WDD, requires door to be notched.</i>				

Set: 18				45.20.10A
Doors: 24				
Description: Panic hardware, passage lever trim				
3	Hinges (std wt)	BB1191	32D	HA
1	Exit Device (passage lever)	2114 4914A	630	PH
1	Surface Door Closer (regular arm)	D-4551 Std	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
1	Wall Stop	230W	US26D	HA
1	Threshold (1/4 inch high)	270A FHSL25	MIL	PE
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Door Sweep	18100 ANB TEK		PE

Set: 19				47.70.10A
Doors: 27				
Description: Storeroom lockset with electric strike				
2	Hinges (std wt)	BB1191	32D	HA
1	Electric Hinge	BB1191 ETW-4	32D	HA
1	Lockset (storeroom, electric)	9K3 7D 15D RQE S3	626	BE
1	Interchangeable cylinder core	33N700007 (Medeco, BLS keyway)	626	BL
1	Electric Strike	1006 CLB	630	HS
1	Surface Door Closer (regular arm)	D-4551 Std	689	ST
1	Kick plate	190S 10" high B4E CSK	US32D	HA
1	Surface overhead stop	700 series stop	626	DM
1	Card Reader	By card reader supplier		
1	Power Supply	PS610RF		DM
1	Door Position Switch	DPS-M-GY		SN
1	Threshold (1/4 inch high)	270A FHSL25	MIL	PE
1	Frame Soffit Seal	S773D (H+J)	BRN	PE
1	Door Sweep	18100 ANB TEK		PE

Set: 20			27.AA.000	
Doors: 25				
Description: Multipoint Latchset (Privacy set).				
3	Hinges (hvy wt)	SP 4-1/2"	26D	MC
1	Multi Point Lock (privacy)	FE6620 NSN	626	RU
1	Surface Door Closer (regular arm)	DC8200 (Through bolt mount)	689	RU
1	Wall Stop	234W	US26D	HA
3	Silencers	307D		HA

END OF SECTION 08 7100

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SECTION 08 8000 - 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. 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. Windows.
 - 2. Doors.
 - 3. Storefront framing.
 - 4. Interior borrowed lites.

1.3 DEFINITIONS

- A. Glass Manufacturers: 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.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.

2. Design Snow Loads: As indicated on Drawings.
 3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Float glass.
 2. Insulating glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass and glazing products, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass and glazing gaskets.
1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- C. Preconstruction adhesion and compatibility test report.
- D. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain ultraclear float glass tinted float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. 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 "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
- C. Available Manufacturers:
 - 1. AGC Glass Company North America
 - 2. Pilkington Building Products North America
 - 3. PPG Industries, Inc.
 - a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - b. For uncoated glass, comply with requirements for Condition A.
 - c. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 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 of 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: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit 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 to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.7 MONOLITHIC-GLASS TYPES

- A. Glass Type: Clear fully tempered float glass.
 - 1. Thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.

2.8 INSULATING-GLASS TYPES

- A. Glass Type: Low-e-coated, insulating glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: 1/4".
 - 3. Outdoor Lite: Class 1 bronze float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Clear float glass.
 - 6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
 - 7. Visible Light Transmittance: 44% percent minimum.
 - 8. Winter Nighttime U-Factor: 0.29.
 - 9. Solar Heat Gain Coefficient: 0.52.
 - 10. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, 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 systems.
 - 3. Minimum required face and 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.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 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 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.
 - 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. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. 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.
- L. 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 GASKET GLAZING (DRY)

- A. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: 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. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets.

Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- E. Install gaskets so they protrude past face of glazing stops.

3.5 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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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 8000

SECTION 08 9000 - LOUVERS AND VENTS

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. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver 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 a uniform pressure of 20 lbf/sq. ft. (957 Pa), acting inward or outward.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.

- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver :
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Warming and Ventilating Model LE-23 or comparable product by one of the following:
 - a. Airolite Company, LLC (The).
 - b. All-Lite Architectural Products.
 - c. Nystrom Building Products.
 - d. Ruskin.
 - 2. Louver Depth: 4 inches (100 mm).
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - 4. Mullion Type: Fully recessed.

2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.5 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: 546 Dark Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. 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.

- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 9000

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SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
- B. Related Requirements:
 - 1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, 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.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings or recommended by the manufacturer.
 - b. Depth: As indicated on Drawings.
 - 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings or recommended by the manufacturer.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track.
 - 3) Steel Network Inc. (The); VertiClip SLD VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track.
- D. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: 1-1/2 inches.
- F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical.
- G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 3/4 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
 - 1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches 600 mm o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 2216

SECTION 09 2900 - 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. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 09 2216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD 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 paper-faced gypsum panels 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 blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. CertainTeed Corp.
 2. Georgia-Pacific Gypsum LLC.
 3. Lafarge North America Inc.
 4. National Gypsum Company.
 5. Temple-Inland.
 6. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FiberCement BackerBoard.
 - b. Custom Building Products; Wonderboard.
 - c. James Hardie Building Products, Inc.; Hardiebacker.
 - d. National Gypsum Company, PermaBase Cement Board.
 - e. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: As indicated.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. 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. 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.

C. 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.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.

E. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 07 2100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. 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.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: On walls, ceilings, and soffits.
 - 2. 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 base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one 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.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive 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 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. 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 09 2900

SECTION 09 3100 - TILING

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:
 - 1. Unglazed wall tile.
 - 2. Unglazed mosaic floor tile.
 - 3. Waterproof and crack isolation membrane for thin-set installation.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Division 9 Section "Gypsum Board" for water-resistant backer board.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces. Show on Elevations.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
- D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- E. Product Certificates: For each type of product, signed by product manufacturer.
- F. Qualification Data: For Installer.
- G. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide as indicated on the Drawings.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Refer to Finish Schedule/Material Legend on Drawings.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved samples.

2.3 TILE PRODUCTS

- A. Manufacturers: Provide products as indicated on Drawings.
- B. Unglazed Wall Tile: Flat tile as follows:
 - 1. Module Size: As indicated on Drawings.
- C. Unglazed Mosaic Floor Tile: Flat tile as follows:
 - 1. Composition: Porcelain.
 - 2. Fascial Dimensions: As indicated on Drawings.
- D. Glazed Ceramic Tile Soap Dish as follows:
 - 1. Product: Dal-tile medium corner BA765.
 - 2. Substitutions: Or equal as approved by Architect.

2.4 WATERPROOF AND CRACK SUPPRESSION MEMBRANE FOR THIN-SET TILE INSTALLATIONS

- A. General: manufacturer's standard product that complies with ANSI A118.10.
- B. Fabric-Reinforced, Fluid-Applied product: System consisting of liquid-latex rubber and fabric reinforcement (for toilet rooms and toilet rooms with showers).
 - 1. Products:
 - a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
 - b. Custom Building Products 9240.

2.5 SETTING AND GROUTING MATERIALS

- A. Manufacturers: (Provide products as indicated on Drawings).
 - 1. For Walls: Custom Building Products ProLite.
 - 2. For Floors: Custom Building Products ProLite.
- B. Chemical resistant, water-cleanable, tile setting grouting: ANSI 118.3
 - 1. For Walls: Quartzlock 2 urethane.
 - 2. For Floors: Quartzlock 2 urethane.

2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Aluminum Edge Protection: Provide the following:
 - 1. Schluter Systems:
 - a. Outside corner and top trim cap: Quadec.
 - b. Color: Anodized Aluminum.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
 - 4. Verify walls are square, true, and confirm dimensions of room are as designed. Notify Architect of all discrepancies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
 - 1. 3/16 inch.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.

- a. Tile floors composed of tiles 2 by 2 inches or larger.

- B. Joint Widths: Install tile on floors with the following joint widths:

1. Mosaic Tile: $\frac{1}{4}$ inch.

3.6 WATERPROOF/CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 3100

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. Provide product indicated on Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

2.5 METAL SUSPENSION SYSTEM

A. Provide product indicated:

1. Armstrong World Industries, Inc.
 - a. Prelude XL (white).

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 - 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 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. 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.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 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.

1.7 FIELD 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. After installation and 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.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Roppe Corporation, USA.
 2. Johnsonite.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 1. Style and Location:
 - a. Style B, Cove: As indicated on Drawings.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.

- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated on Drawings.

2.2 THERMOPLASTIC-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Roppe Corporation, USA.
 - 2. Johnsonite.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style to be rectangular shaped profile with a 45 degree chamfer top: As indicated on Drawings.
- C. Thickness: 0.375 inch.
- D. Height: 4 ½".
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed miter.
- G. Inside Corners: Job formed miter.
- H. Colors: As indicated on Drawings.

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 resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

- 1. Adhesives shall have a VOC content of 50 g/L or less.

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.

- 1. 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.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

- 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

- 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

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 practical without gaps at seams and with tops of adjacent pieces aligned. Installed scrap pieces smaller than 12" in length will not be accepted.
- 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.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting 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 horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal 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. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

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SECTION 09 6516.13 - LINOLEUM 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. Linoleum 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.
 - 2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor coverings.

1.3 ACTION 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 Verification: Full-size units of each color and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.
- B. Warranty: Special warranties specified in this Section.

1.6 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.
- C. Pre-Installation Conference: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Div. 1 Project Management and Coordination Section.
 - 1. Manufacturer's representative to participate in the pre-installation conference.

1.7 WARRANTY

- A. Special Warranty for Linoleum Tile: Manufacturer's standard form in which manufacturer agrees to repair or replace components of linoleum tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 30 year system life warranty.

1.8 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 68 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 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 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 68 deg F or more than 95 deg F.
- 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 RESILIENT LINOLEUM TILE - MCT

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Forbo Flooring, Inc.; Marmoleum Composition Tile.

- B. Tile Standard: ASTM F 1700.
 - 1. Class: Class I, monolithic vinyl tile.
 - 2. Type: Type A, smooth surface.
- C. Thickness: 0.080 inch.
- D. Size: 13 x 13 inches.
- E. Colors and Patterns: As indicated in the Material Legend.
- F. Finish: Provide with manufacturer's standard Topshield finish.

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 floor tile and substrate conditions indicated.

PART 3 - EXECUTION

PART 4 - 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.

4.2 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. 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.

4.3 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 in pattern indicated.
- 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 quarter turns.
- 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. 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.

4.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile. Manufacturer will provide training to the Owner.
- 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 mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.

Cover floor tile until Substantial Completion.

END OF SECTION 09 6516.13

SECTION 09 6566 - RESILIENT ATHLETIC 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. Interlocking, rubber floor tile.
- B. Related Sections:
 - 1. Section 09 6513 "Resilient Base and Accessories" for wall base and accessories installed with flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch-square Samples of same thickness and material indicated for the Work.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For flooring to include in maintenance manuals.

1.5 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Install flooring after other finishing operations, including painting, have been completed.

1.8 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

PART 2 - PRODUCTS

2.1 INTERLOCKING, RUBBER FLOOR TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by the following:
 - 1. Johnsonite; a Tarkett company.
- B. Description: Athletic flooring consisting of modular rubber tiles with precision cut, interlocking edges, for free-lay installation.
- C. Material: Recycled-rubber compound.
- D. Tile Interlock: Hidden.
- E. Traffic-Surface Texture: Nondirectional, stipple texture.
 - 1. Provide reversible tiles (with traffic-surface texture on both sides).
- F. Size: 24 inches square.
- G. Thickness: 3/8 inch.
- H. Color and Pattern: Refer to Material Legend on Drawings.

2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

PART 3 - EXECUTION

3.1 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.2 FLOOR TILE INSTALLATION

- A. Lay out 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.
- B. Discard broken, cracked, chipped, or deformed tiles.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.
- D. Free-Lay Flooring: Place flooring at locations indicated with all units securely interconnected and fully seated on substrate to form a smooth, level surface.

3.3 CLEANING AND PROTECTING

- A. Perform the following operations immediately after completing flooring installation:
 - 1. Sweep and vacuum flooring thoroughly.
 - 2. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6566

SECTION 09 6700 – FLUID APPLIED FLOORING FOR CONCRETE

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Fluid-applied flooring for Concrete.

1.2 RELATED SECTIONS

- A. Section 03 3000 - Cast-In-Place Concrete.

1.3 REFERENCES

- A. SSPC-SP 1 - Solvent Cleaning
- B. SSPC-SP 2 - Hand Tool Cleaning
- C. SSPC-SP 3 - Power Tool Cleaning
- D. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete
- E. ASTM F1869 - Moisture Test by use of Calcium Chloride
- F. ASTM D4258 - Standard Practice for Cleaning Concrete
- G. ASTM D4259 - Standard Practice for Abrading Concrete
- H. ASTM D4260 - Standard Practice for Etching Concrete
- I. ASTM D4263 - Plastic Sheet Method for Checking Moisture in Concrete
- J. ICRI # 03732

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3300, Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each paint and coating product should include:
 - 1. Product characteristics.

2. Surface preparation instructions and recommendations.
 3. Primer requirements and finish specification.
 4. Storage and handling requirements and recommendations.
 5. Application methods.
 6. Cleanup information.
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.
- D. Qualification Data: For Installer.
- E. Coating Maintenance Manual: upon conclusion of the project, the Contractor or paint manufacture/supplier shall furnish a coating maintenance manual. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
1. Product name, and type (description)
 2. Application & use instructions
 3. Surface preparation
 4. VOC content
 5. Environmental handling
 6. Batch date
 7. Color number
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- C. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. **The Sherwin-Williams Company**
101 Prospect Avenue NW
Cleveland, OH 44115
Tel: (800) 321-8194
Fax: (216) 566-1392
www.sherwin-williams.com
2. **Stonhard Stonkote GS4 epoxy system with Stonseal GS6 urethane topcoat at 3-mils thickness.**

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 6000 Product Requirements. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.2 APPLICATION/SCOPE

A. Provide in areas as indicated on the drawings.

2.3 PRODUCTS

A. Epoxy System:

- 1st Coat: ArmorSeal 1000 HS Epoxy, B67-2000 Series
(3.0 - 5.0 mils dry per coat)
- 2nd Coat: ArmorSeal 1000 HS Epoxy, B67-2000 Series
- 3rd Coat: ArmorSeal 1000 HS Epoxy, B67-2000 Series
(3.0 - 5.0 mils dry per coat)

2.4 MATERIALS - GENERAL REQUIREMENTS

A. Paints and Coatings - General:

1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers:

1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.5 ACCESSORIES

A. Coating Application Accessories:

1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly examined and prepared. Notify Architect or Specifier of unsatisfactory conditions before proceeding.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.2 SURFACE PREPARATION

- A. Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.
- B. Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.
- C. Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.
- D. Poured Concrete
 1. New:

For surface preparation, refer to SSPC-SP13/NACE 6/ICRI # 03732. Surfaces must be clean, dry, sound and offer sufficient profile to achieve adequate adhesion. Minimum substrate cure is 28 days at 75°F. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign matter by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. Refer to ASTM D4260. Rinse thoroughly to achieve a final pH between 8.0 and 10.0. Allow to dry thoroughly prior to coating.

- E. Fill all cracks, voids, bug holes and joints with appropriate filler or ArmorSeal Crack Filler, ArmorSeal Joint Sealant, or ArmorSeal Expresspatch.
- F. Always follow the ASTM methods listed below:
 - 1. ASTM F1869 Moisture Test by use of Calcium Chloride
 - 2. ASTM D4258 Standard Practice for Cleaning Concrete.
 - 3. ASTM D4259 Standard Practice for Abrading Concrete.
 - 4. ASTM D4260 Standard Practice for Etching Concrete.
 - 5. ASTM D4263 Plastic Sheet Method for Checking Moisture in Concrete.
 - 6. SSPC-SP 13/Nace 6 Surface Preparation of Concrete.
 - 7. ICRI # 03732 Surface Preparation of Concrete.

3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendation.
- B. Do not apply to wet or damp surfaces.
 - 1. Wait at least 28 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 28 days.
 - 2. Test new concrete for moisture content.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickness.

3.4 PROTECTION

- A. Protect finished coatings from damage until completion of project.

- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION 09 6700

SECTION 09 6813 - 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. Section includes modular, fusion-bonded carpet tile.
- B. Related Requirements:
 - 1. Section 09 6513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. 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.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, 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.

1.7 QUALITY ASSURANCE

- A. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- 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.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: 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 edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Shaw Contract.
- B. Color & Pattern: Refer to materials legend on finish schedule.
- C. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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 Section 03 3000 "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.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove yarns that protrude from carpet tile surface.
 - 2. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting 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 09 6813

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SECTION 09 9113 - 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. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 09 9123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. 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, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 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.

1.7 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect.
 - 1. 100 percent of surface area will be painted with deep tones.

2.3 METAL PRIMERS

- A. Primer, Galvanized, Water Based: MPI #134.

2.4 WATER-BASED PAINTS

- A. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (Gloss Level 5): MPI #163.

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 the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 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.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.
 - f. Exposed PVC piping.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
- b. Prime Coat: Shop primer specified in Section where substrate is specified.
- c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, galvanized, water based, MPI #134.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.

END OF SECTION 09 9113

SECTION 09 9123 - INTERIOR 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. Section includes surface preparation and the application of paint systems on interior substrates.
 - 1. Concrete masonry units (CMU).
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Gypsum board.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 09 9113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. 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.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 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.

1.7 FIELD 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 when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Sherwin-Williams Company (The).

- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. Colors: Match Architect's samples. Refer to Drawings.
 - 1. 15 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107.
- B. Primer, Galvanized, Water Based: MPI #134.

2.6 LATEX PAINTS

- A. Institutional Low Odor/VOC Latex, Flat (Gloss Level 1): MPI #143.
 - 1. VOC Content: E Range of E3.
 - 2. Environmental Performance Rating: EPR 4.
- B. Institutional Low Odor/VOC Latex (Eggshell), (Gloss Level 3): MPI #145.
 - 1. VOC Content: E Range of E3.

2. Environmental Performance Rating: EPR 4.5.
- C. High Performance Architectural Latex (Eggshell) (Gloss Level 3): MPI #139.
 1. VOC Content: E Range of E3.
 2. Environmental Performance Rating: EPR 5.
- D. High Performance Architectural Latex, Semi-Gloss (Gloss Level 5): MPW #141.
 1. VOC Content: E Range of E1.
 2. Environmental Performance Rating: EPR 5.

2.7 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings 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.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.

5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- 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.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Other items as directed by Architect.
 - b. Ductwork.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing

and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. System:
- B. CMU Substrates: (Except in Apparatus Bays and rooms directly adjacent)
 - 1. System:
 - a. Block Filler: B25W00025 – PrepRite Block Filler White.
 - b. Intermediate Coat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - c. Topcoat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.
- C. CMU Substrates within Apparatus Bays and all directly adjacent rooms:
 - 1. System:
 - a. Block Filler, Heavy Duty B42W46 (18 mils wet).
 - b. Intermediate Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series.
 - c. Top Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series (4 mils wet, 1.5 mils dry per coat).
- D. Steel Substrates: (Below 8'-0" in Apparatus Bays and door frame)
 - 1. System:

- a. Prime Coat: B66W00310 – Pro Industrial Pro-Cryl Universal Primer Off White.
 - b. Intermediate Coat: K45W00051 – Pro Industrial Waterbased PreCatalyzed Epoxy Eg-Shel.
 - c. Topcoat: K45W00051 – Pro Industrial Waterbased PreCatalyzed Epoxy Eg-Shel.

- E. Steel Substrates: (Above 8'-0" elevation in Apparatus Bays)
 - 1. System:
 - a. Prime Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-80 Series (60 mils wet, 1.9 mils dry per coat).

- F. Galvanized-Metal Substrates:
 - 1. System:
 - a. Prime Coat: B66W00310 – Pro Industrial Pro-Cryl Universal Primer Off-White.
 - b. Intermediate Coat: K45W00051 Pro Industrial Waterbased PreCatalyzed Epoxy Eg-Shel.
 - c. Topcoat: K45W00051 – Pro Industrial Waterbased PreCatalyzed Epoxy Eg-Shel.

- G. Wood Substrates: Including wood trim.
 - 1. System:
 - a. Prime Coat: B28W08111 – Premium Interior Wall and Wood Primer White.
 - b. Intermediate Coat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - c. Topcoat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.

- H. Gypsum Board Substrates:
 - 1. System:
 - a. Prime Coat: B28W02600 – ProMar 200 Zero VOC Interior Latex Primer White.
 - b. Intermediate Coat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.
 - c. Topcoat: B20W02651 – ProMar 200 Zero VOC Interior Latex Eg-Shel.

END OF SECTION 09 9123

SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

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. Fabricated channel dimensional characters.

1.3 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign.
- C. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Fabricated Channel Characters, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.

1. Character Material: Sheet or plate aluminum or stainless steel.
2. Material Thickness: As indicated on drawings.
3. Character Height: As indicated on drawings.
4. Character Depth: As indicated on drawings
 - a. Characters over 1" depth to have backs.
5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 1419

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SECTION 10 2600 – IMPACT-RESISTANT WALL PROTECTION

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:
 - 1. Vinyl corner guards.
 - 2. Impact-resistant wall coverings.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.
- B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Wall and Corner Guards: 12 inches long. Include examples of joinery, corners, end caps, top caps, and field splices.
 - 2. Impact-Resistant Wall Covering: 6 by 6 inches square.
- D. Qualification Data: For testing agency.
- E. Material Test Reports: For each impact-resistant plastic material.
- F. Material Certificates: For each impact-resistant plastic material, signed by manufacturer.
- G. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 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.
- D. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall-protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic sheet material out of direct sunlight.
 - 3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.
- B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.
- C. Do not expose to direct sun light.

- D. Maintain wall temperature between 65°-85° F during installation.
- E. Do not install if relative humidity is greater than 80%.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Vinyl wall protection sheets: Provide four (4) full sheets of each color or texture provided.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

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. Manufacturers:
 - a. IPC Door and Wall Protection Systems, www.inprocorp.com.
 - b. Pawling Corporation

2.2 MATERIALS

- A. Stainless Steel: Corner Guards shall be manufactured from Type 304, 16 gauge Stainless Steel.
- B. Plastic Sheet Wall Covering Material: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, semirigid, high-impact-resistant PVC or acrylic-modified vinyl plastic sheet with integral color throughout; thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.

- C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- E. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

2.3 VINYL CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards (CG-1): Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. Inpro Corporation; 160BN surface mount corner guard.

2.4 IMPACT-RESISTANT WALL COVERINGS

- A. Semirigid, Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall covering material.
 - 1. Size: As indicated on the Drawings.
 - 2. Sheet Thickness: 0.040 inch.
 - 3. Color, Pattern, and Texture: As indicated on the Drawings.
 - 4. Height: As indicated on the Drawings.
 - 5. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - 6. Mounting: Adhesive: as approved by protective wall covering manufacturer.

2.5 FABRICATION

- A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Impact-Resistant Wall Covering: Provide top and edge moldings, corners, and divider bars as required for a complete installation.
- B. Install impact resistant wall protection units in locations and at mounting heights indicated on the Drawings.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 2600

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SECTION 10 2800 - TOILET AND BATH ACCESSORIES

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:
 - 1. Public-use washroom accessories.
 - 2. Custodial 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 products using 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.

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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. 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.
- D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products as indicated on the Drawings.
- B. Product: The basis of design for accessories is based on products indicated.
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Alternate Manufacturer: American Specialties, Inc.
- C. Grab Bar: (Straight bars): TS-1 (set), TS-2, TS-3
 - 1. Product: Bobrick; B-6806.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
 - 4. Sizes: TS-1 = 18", 36", 42" (set)
TS-2 = 24"
TS-3 = 48"

5. Outside Diameter: 1-1/4 inches.
6. Configuration and Length: As indicated on the Drawings.

D. Framed Mirror: TS-4

1. Product: Bobrick; B-290 Series (no shelf required).
2. Size: 18" x 36".
3. Frame: Stainless-steel angle, 0.05 inch thick.
 - a. Corners: Manufacturer's standard.
4. Hangers: Produce rigid tamper- and theft-resistant installation, using manufacturer's wall hanger and integral hanging brackets.

E. Shower Curtain Rod: TS-5

1. Product: Bobrick; B-207.
2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch-thick stainless steel.
3. Mounting Brackets: Concealed.

F. Robe/Utility Hook: TS-7

1. Product: Bobrick; B-76727.
2. Description: Double Robe Hook.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Folding Shower Seat: TS-6

1. Product: HealthCraft WS-WD SerenaSeat.
2. Description: Fold-up shower seat – 26' width.
3. Material and Finish: Walnut, Powder Coated Grey

2.3 CUSTODIAL ACCESSORIES

A. Product: The design for accessories is based on product indicated.

1. Bobrick Washroom Equipment, Inc.

B. Utility Shelf with Mop/Broom Holders: EQ-22

1. Product: Bobrick; B-239.

2.4 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 250 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 2800

SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 4416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GMR International Equipment Corporation.
 - b. Guardian Fire Equipment, Inc.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Modern Metal Products, Division of Technico Inc.
 - e. Nystrom, Inc.
 - f. Strike First Corporation of America.
 - g. Larsen's Manufacturing Company.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Steel sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.

- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated.
 - 1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

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SECTION 10 4416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated.
 - b. Buckeye Fire Equipment Company.
 - c. J.L. Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - e. Larsens Manufacturing Company.
 - f. Nystrom Building Products.
 - g. Potter Roemer LLC.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

- B. Multipurpose Dry-Chemical Type: 10 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated.
 - c. Badger Fire Protection.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. Guardian Fire Equipment, Inc.
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - h. Larsens Manufacturing Company.
 - i. Nystrom Building Products.
 - j. Potter Roemer LLC.
 - k. Strike First Corporation of America.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

SECTION 10 7500 - FLAGPOLES

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 ground-mounted flagpoles made from aluminum.
- B. Owner-Furnished Material: Flags.
- C. Related Sections:
 - 1. Section 26 5100 "Lighting" for site lighting fixtures.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
 - 1. Wind Loads: according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
 - 2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 - 1. Include section, and details of foundation system for ground-mounted flagpoles.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

- D. Delegated-Design Submittal: For flagpole assemblies 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. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Flagpole; a Kearney-National Inc. company.
 - 2. Baartol Company.
 - 3. Ewing Flagpoles.
 - 4. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
 - 5. Pole-Tech Company Inc.
 - 6. U.S. Flag & Flagpole Supply, LP.

2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
 - 3. Provide self-aligning, snug-fitting joints.
- B. Exposed Height: 35 feet.
- C. Aluminum Flagpoles: Provide cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
- D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
 - 1. Provide flashing collar of same material and finish as flagpole.

2.3 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch spun aluminum, finished to match flagpole.
- B. External Halyard: Ball-bearing, nonfouling, truck assembly of cast metal with continuous 5/16-inch- diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 - 1. Provide one halyard and one cleat at each flagpole.
 - 2. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.
 - a. Provide with neoprene or vinyl covers.

2.4 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C 33, fine aggregate.
- D. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 9200 "Joint Sealants" for Use NT' (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- D. Place concrete, as specified in Section 03 3000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Ground Set: Place sleeve, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level sleeve and allow concrete to cure. Install flagpole, plumb, in sleeve.
 - 1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.
- C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.
- D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 10 7500

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DIVISION 21 FIRE SUPPRESSION

21 0000 General Requirements for Fire Suppression Systems

- 21 0001 Basic Fire Suppression Requirements
- 21 0004 Firestopping for Fire Suppression Systems

21 0500 Common Work Results for Fire Suppression

- 21 0519 Meters and Gauges
- 21 0529 Pipe Hangers and Supports
- 21 0553 Identification for Fire Suppression Systems

21 1000 Water Based Fire Suppression Systems

- 21 1313 Wet Pipe Sprinkler Systems

21 2000 Clean-Agent Fire Extinguishing Systems

- 21 2213 Clean-Agent Fire Extinguishing Systems

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SECTION 21 0001 – BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Fire Suppression work.
- C. A complete and functional Fire Suppression system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SCOPE OF WORK

- A. The scope of the Fire Suppression work includes furnishing, installing, testing and warranty of all Fire Suppression work shown on the Fire Suppression drawings and specified herein, including Division 00, division 01, Division 21 and applicable provisions of other relevant Divisions.

1.4 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “proved,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect’s decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.5 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.6 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. The fire suppression contractor shall be responsible to prepare a permit set of documents to file for and obtain all required permits from the governing inspection agencies. Include payment of all permit and inspection fees applicable to the work in this Division.
- C. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- D. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.7 COORDINATION DRAWINGS

- A. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression, Electrical, Technology, Kitchen Equipment and General Contractor ("Coordination Participant") for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings. No work shall be installed or fabricated until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Construction Manager.
- B. Each Coordination Participant shall use the coordination drawings as a baseline to develop drawings of its own work, specifically locating equipment, devices, piping, conduits, structural elements etc.
- C. Each Coordination Participant shall return its drawings to the HVAC contractor. From these the HVAC contractor shall produce the Detailed Coordination Drawings.
- D. Detailed Coordination Drawings: Plans, drawn to scale (1/4" = 1'-0") for all areas of the building including mechanical rooms and kitchen. The following items shall be shown and coordinated with each other, using input from the Participants:
 - 1. Ductwork, including detailed dimensions and elevations for all block wall penetrations.
 - 2. HVAC Equipment and ductwork accessories.
 - 3. HVAC Piping
 - 4. Plumbing Piping, including storm drainage and plumbing vents
 - 5. Fire Protection Piping
 - 6. Kitchen Hoods, Exhaust Fans and associated ductwork
 - 7. Cable Tray
 - 8. Electrical and Technology Conduits 2" and above.
 - 9. Building structural elements
 - 10. Suspended ceiling components.
 - 11. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures, including pendant fixtures.

- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

1.8 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. Fire suppression design and work shall be performed by licensed Fire Suppression Contractors in accordance with requirements of the jurisdiction.

1.9 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.10 PAINTING

- A. Refer to 099123 Interior Painting.

- B. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 21:
 - 1. Ferrous metal which is no factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
- C. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.
- D. Finish painting is included in the General Contract.

1.11 EQUIPMENT SELECTION

- A. Refer to Section 13300 Submittal Procedure.
- B. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal:" appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

- D. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- E. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- F. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.12 SHOP DRAWINGS

- A. Refer to Section 013300 Submittal Procedure.
- B. Refer to Section 013300 Submittal Procedure.
- C. Shop drawings and descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted for review as required by Section 013300. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- D. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- E. The review of shop drawings shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- F. Shop drawings for the following Fire Suppression equipment and materials shall be submitted
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers.
 - 4. Valves.
 - 5. Gauges.
 - 6. Sprinkler heads and accessories.
 - 7. Wet pipe components.
 - 8. Fire department valves
 - 9. Fire department connections.
 - 10. Sprinkler system installation drawings per NFPA 13, applicable calculations and water supply flow curve.
 - 11. Clean agent fire extinguishing system components and installation drawings

1.13 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. Provide supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations. This effort shall be considered supplementary to warranty provisions required under Section 017700.
- C. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.

1.14 OPERATING AND MAINTENANCE DATA

- A. Refer to Section 017823 Operation and Maintenance Data.

1.15 DEMONSTRATION AND TRAINING

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 21 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 4 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 21 0001

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SECTION 21 0004 – FIRESTOPPING FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 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: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 21 0004

SECTION 21 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gauges.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, equal to Trerice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in. or 0-5 psi, as appropriate, shall be equal to Trerice 860.
- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, equal to Trerice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.2 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers shall be installed where shown on the drawings and also at:
- B. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at:
- C. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
- D. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position

END OF SECTION 21 0519

SECTION 21 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Hanger Rods and Attachments.
 - 4. Pipe Riser Supports
 - 5. Base Mounted Pipe Supports
- B. See Specification Section 21 0516 "Expansion Fittings and Loops" for pipe guides and anchors.
- C. See Specification Section 21 Seismic Control for Fire Suppression Systems for seismic isolation devices.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
 - 1. Pear shaped band hanger with adjustable swivel ring type per NFPA standards, lock nut and rod attachment, carbon steel with galvanized finish, Anvil fig. 69.

2.2 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nut at the hanger attachment shall be provided on each hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
4" and smaller	3/8"
5" to 6"	1/2"
8"	5/8"

B. Hanger rod attachment devices for attachment to the structure shall be:

1. Pre-set concrete inserts.
2. After-set steel expansion type concrete inserts.
3. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
4. Side beam bracket for wood construction equal to Anvil Fig. 206.
5. Channel support system equal to Unistrut or Hilti.

2.3 PIPE RISER SUPPORTS

A. Riser clamps shall be:

1. Carbon steel, epoxy coated or galvanized finish- Anvil Fig. 261.

2.4 BASE MOUNTED PIPE SUPPORTS

A. Base mounted pipe supports shall be factory or shop prime coat painted equal to Anvil Fig. numbers as follows:

1. Adjustable pipe saddle support and yoke– Fig. 265.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing of hangers shall be as follows:

1. Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft.. intervals.
 - d. 1-1/2" thru 2" – 8 ft.. intervals

- e. 2-1/2" and larger – 10 ft. intervals
- B. In piping systems with rolled or cut groove end pipe and mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Added supports may be omitted on "rigid" couplings such as Victaulic Style 07 Zero-Flex. Vertical piping shall be supported at normal specified intervals or every other pipe length, whichever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
 - 1. Pre-set concrete inserts in concrete construction of 4" minimum depth.
 - 2. After-set concrete inserts, in 4" minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.
 - 3. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 - 4. Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
 - 5. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel deck with concrete slab poured deck. Refer to 1 and 2 above.
- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturers recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position.
- F. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within finished spaces. Insure that adequate support is still maintained.

END OF SECTION 21 0529

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SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve Tags

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Each item or major equipment shall be labeled.

B. Labeling shall be:

1. Permanently attached plastic laminated signs with 1" high lettering. Signs on exterior equipments shall be brass.

2.2 PIPE LABELS

A. Pipe markings shall be applied to all piping.

B. Labeling shall be:

1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.

2.3 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be engraved plastic laminate with solid brass S hook. Tags shall be engraved with "F" for Fire Suppression and the designated number.

2.4 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after painting has been completed.
- B. Coordinate names, abbreviations and other designations used with corresponding designations shown, specified or scheduled on drawings. Verify with Owners' desired identification marking system.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.
- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 21 0553

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Excess-pressure pumps.
6. Alarm devices.
7. Pressure gages.

B. Related Sections:

1. Division 21 Section "Dry-Pipe Sprinkler Systems" for dry-pipe sprinkler piping.
2. Division 21 Section "Electric-Drive, Vertical-Turbine Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Design sprinkler system(s), by a State certified designer, using performance requirements and design criteria indicated.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- C. System shall conform to the requirements of NFPA 13 and OBC chapter 9 and other requirements of the authority having jurisdiction.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and OBC building seismic use group III. and seismic design category C.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Approved Sprinkler Piping Drawings and Calculations: Working plans and hydraulic calculations, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Welding certificates.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Design Responsibility: Preparation of working plans, calculations, and field test reports by a certified sprinkler designer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig.
3. Acceptable Manufacturers: Subject to compliance with requirements:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Stockholm Valve and Fittings.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Watts Water Technologies, Inc.

B. Check Valves 2 1/2" and larger:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Cast iron.
4. Disc Material: Bronze
5. End Connections: Flanged or grooved.

C. Check Valves 2" and smaller:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Bronze.
4. Disc Material: Composition faced
5. End Connections: Threaded.

D. OS&Y Gate Valves 2" and smaller:

1. Standard: UL 262.
2. Body Material: Bronze.
3. End Connections: Threaded.

E. OS&Y Gate Valves: 2 1/2" and larger

1. Standard: UL 262.
2. Body Material: Cast or ductile iron.
3. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves 2" and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.

- c. End Connections: Threaded.
- 4. Valves 2-1/2" and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
- 5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.
- G. Trim and Drain Ball Valves:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Body Material: Bronze.
 - 3. End Connections: Threaded.

2.3 SPECIALTY VALVES

- A. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Material: Cast or ductile iron.
 - 4. Size: Same as connected piping.
 - 5. End Connections: Flanged or grooved.
 - 6. Acceptable manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
- B. Alarm Valves:
 - 1. Standard: UL 193.
 - 2. Design: For horizontal or vertical installation.
 - 3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - 4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
- C. Automatic (Ball Drip) Drain Valves:
 - 1. Standard: UL 1726.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Type: Automatic draining, ball check.
 - 4. Size: 3/4".
 - 5. End Connections: Threaded.

2.4 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Standard: UL 405.
2. Type: Flush, for wall mounting.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Corrosion-resistant metal.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, brass, wall type.
8. Outlet: With pipe threads.
9. Body Style: Horizontal.
10. Number of Inlets: Two.
11. Outlet Location: Bottom.
12. Escutcheon Plate Marking: Similar to " AUTO SPKR."
13. Finish: Polished chrome plated.
14. Outlet Size: 4".
15. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Guardian Fire Equipment, Inc.
 - c. Potter Roemer.

2.5 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig .
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

B. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

8. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.

C. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Viking Corporation.

2.6 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
3. Acceptable Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.

B. Automatic Sprinklers:

1. Early-Suppression Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Quick-response type with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler Finishes:

1. Rough brass.
2. Chrome plated.
3. Painted.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.

1. Exposed Pendent Sprinklers: White-plated steel, one piece, flat.

2. Concealed Recessed Sprinklers: White -plated steel, two piece, with 1-inch vertical adjustment and a flat cover plate.
 3. Sidewall Mounting: White -plated steel one piece, flat.
- E. Sprinkler Guards:
1. Standard: UL 199.
 2. Type: Wire cage with fastening device for attaching to sprinkler.
- F. In spaces subject to freezing use dry pendent sprinklers.
- G. Spare sprinklers. Furnish spare sprinklers and sprinkler wrench in accordance with the requirements of NFPA 25. spare sprinklers shall include each type and temperature rating in a proportional amount equal of those installed. Provide a wall mounted cabinet for sprinklers and wrench.

2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicators:
1. Standard: UL 346.
 2. Water-Flow Detector: Electrically supervised.
 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 4. Type: Paddle operated.
 5. Pressure Rating: 250 psig.
 6. Design Installation: Horizontal or vertical.
 7. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Victaulic Company.
- C. Valve Supervisory Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design: Signals that controlled valve is in other than fully open position.
 5. Manufacturers:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2.8 PIPE ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Water-Service."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.[Comply with requirements for backflow preventers in Division 21 Section "Facility Water-Service."]

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Locate sprinkler piping in areas protected from freezing.
- C. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- D. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13 and OBC.

- E. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- F. Install unions adjacent to each valve in pipes 2" and smaller.
- G. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- H. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- I. Install sprinkler piping with drains for complete system drainage.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than 1/4" and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Install escutcheons for penetrations of walls, ceilings, and floors.
- O. Fill sprinkler system piping with water.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 1. Shop weld pipe joints where welded piping is indicated.
- G. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install backflow preventer in potable-water-supply sources.
- D. Specialty Valves:
 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

- A. Refer to the drawing for the locations of various types of sprinklers.
- B. Install sprinklers in suspended ceilings in center of acoustical ceiling panels or at the quarter points along the long axis for rectangular panels.
- C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- D. Install sprinkler guards on sprinklers in gymnasiums.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections. Location to be approved by local Fire Department.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, and walls.
- B. Sleeves are not required for core-drilled holes in cast walls or floors.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Coordinate with fire-alarm tests. Operate as required.
 5. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Turn spare sprinklers, wrench and cabinet over to owner

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.11 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded or grooved cast-iron fittings; and joints.

3.12 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 1. Concealed Sprinklers: Rough brass, with factory-painted flat white cover plate.
 2. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 1313

SECTION 21 2213 - CLEAN-AGENT FIRE EXTINGUISHING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes clean-agent extinguishing systems with a detection and release system.

1.2 SYSTEM DESCRIPTION

- A. Double Interlocked clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity below the ceiling and below the raised floor. Provide two separate detection systems are used to detect fire activity. Detection of fire activity from both systems is required to trigger a release of agent.

1.3 STANDARDS AND CODES

- A. The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards:
 - 1. National Fire Protection Association (NFPA) Standards:
 - a. NFPA 2001 Clean Agent Fire Extinguishing Systems
 - b. NFPA 70 National Electric Code
 - c. NFPA 72 National Fire Alarm Code
 - 2. Factory Mutual Systems (FM) Publications
 - 3. Factory Mutual Approval Guide
 - 4. Underwriters Laboratories, Inc. (UL) Publication
 - 5. National Electrical Manufacturers Association (NEMA) Publication "Enclosures for Industrial Controls and Systems"
 - 6. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044 (SNAP)
 - 7. Requirements of the State and Local codes in force at time of award of contract.
- B. The standards listed, as well as all other applicable codes, standards, and good engineering practices, shall be used as "minimum" design standards.

1.4 PERFORMANCE REQUIREMENTS

- A. The system shall be a clean agent system as defined in NFPA 2001.
- B. The system shall provide a minimum design concentration as recommended by NFPA 2001 and the agent manufacturer, at the minimum anticipated temperature within the protected area. System design shall be equipped with provisions for room evacuation before agent release.
- C. The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, agent storage containers agent, discharge

nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training and any other operations necessary for a functional UL listed clean agent suppression system.

- D. Provide two (2) inspections during the first year of service: Inspections shall be made at 6-month intervals commencing when the system is first placed into normal service.
- E. The general contractor shall be responsible for sealing and securing the protected spaces against agent loss and/or leakage during the 10-minute "hold" period.
- F. Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.
- G. Automatic operation of each protected area shall be as follows:
 - 1. Actuation of one (1) detector, within the system, shall:
 - a. Illuminate the "ALARM" lamp on the control panel face.
 - b. Energize an alarm bell.
 - c. Transfer auxiliary contacts, which can perform auxiliary system functions such as;; Transmit a signal to a fire alarm system; Shutdown HVAC equipment.
 - d. Light an individual lamp on an optional annunciator.
 - 2. Actuation of a 2nd detector, within the system, shall:
 - a. Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
 - b. Energize pre-discharge horn/strobe devices.
 - c. Shut down the HVAC system and/or close dampers.
 - d. Start time-delay sequence (not to exceed 60 seconds).
 - e. System abort sequence is enabled at this time.
 - f. Light an individual lamp on an optional annunciator.
 - 3. After completion of the time-delay sequence, the clean agent system shall discharge and the following shall occur:
 - a. Illuminate a "SYSTEM FIRED" lamp on the control panel face.
 - b. Energize a visual indicator(s) outside the hazard in which the discharge occurred.
 - c. Energize a "System Fired" audible device.
 - 4. The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence description above except that the time delay and abort functions shall be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.
- H. Manual stations shall immediately discharge extinguishing agent when activated.
- I. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.

1.5 QUALITY ASSURANCE

A. MANUFACTURER

- 1. The manufacturer of the suppression system hardware and detection components shall be ISO 9001 registered.
- 2. The name of the manufacturer shall appear on all major components.

3. All devices, components, and equipment shall be the products of the same manufacturer, or supplied by the same manufacturer.
4. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.
5. All devices and equipment shall be UL listed and/or FM approved.
6. Locks for all cabinets shall be keyed alike.

B. INSTALLER

1. The installing contractor shall be trained by the supplier to design, install, test, and maintain fire suppression systems.
2. The installing contractor shall employ a NICET certified special hazard designer, Level II or above, who will be responsible for this project.
3. The installing contractor shall be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire suppression systems, in strict accordance with all applicable codes and standards.
4. The installing contractor must have a minimum of five (5) years' experience in the design, installation, and testing, of clean agent, or similar fire suppression systems. A list of systems of a similar nature and scope shall be provided on request.
5. The installing contractor shall show evidence that his company carries a minimum \$2,000,000.00 liability and completed operations insurance policy. These limits shall supersede limits required in the general conditions of the specifications.
6. The installing contractor shall maintain, or have access to, a clean agent recharging station. The installing contractor shall provide proof of his ability to recharge the largest clean agent system within 24 hours after a discharge. Include the amount of bulk agent storage available.
7. The installing contractor shall be an authorized stocking distributor of the clean agent system equipment so that immediate replacement parts are available from inventory.
8. The installing contractor shall show proof of emergency service available on a twenty-four hour-seven day-a-week basis.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Submit a preliminary equipment layout drawing to the owner for review.
- C. The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:
 1. Field installation layout drawings having a scale of not less than 1/8 in. = 1 ft.- 0 in. or 1:100 detailing the location of all agent storage tanks, nozzles, pipe runs, including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, etc.
 2. Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdown.
 3. Separate layouts, or drawings, shall be provided for each level, (i.e.; room, sub floor, and above ceiling) and for mechanical and electrical work.

4. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method(s) used for detector mounting.
 5. Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.
 6. Separate drawing providing symbol legend and identifying all symbols used.
 7. Annunciator wiring schematics and dimensioned display panel illustration shall be provided. (Optional device.)
 8. Complete hydraulic flow calculations, from a UL listed computer program, shall be provided for all engineered clean agent systems. Calculation sheet(s) must include the manufacturer's name and UL listing number for verification. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by zone.
 9. Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices, and auxiliary components under full load conditions.
 10. A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay, and agent discharge for each zone or system.
- D. Once the preliminary layout is approved, submit drawings, calculations and system component sheets prepared according to NFPA 2001 for approval to the local fire prevention agency, owner's insurance underwriter, and all other authorities having jurisdiction before starting installation. Submit approved plans to the architect/engineer for record.
- E. Field quality-control test reports.
- F. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. GENERAL REQUIREMENTS

1. The clean agent system materials and equipment shall be standard products of the supplier's latest design and suitable to perform all functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.
2. All devices and equipment shall be U.L. Listed and/or FM approved.
3. Each system shall have its own supply of clean agent.
4. The system design can be modular, central storage, or a combination of both design criteria.
5. Systems shall be designed in accordance with the manufacturer's guidelines.
6. Each supply shall be located within the hazard area, or as near as possible, to reduce the amount of pipe and fittings required to install the system.
7. The clean agent shall be stored in. pressurized storage tanks. Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.

8. Tanks (master) shall be actuated by either a resettable electric actuator or by pneumatic means from a nitrogen cartridge located in the releasing device. Explosive devices shall not be permitted.
9. Each tank shall have a pressure gauge and low pressure switch (optional) to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual "Trouble" alarms in the event the container pressure drops below 290 psi (20 bar). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
10. Tanks shall have a pressure relief provision that automatically operates before the internal nominal pressure exceeds 730 psi (50 bar).
11. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution. Nozzles shall be available in ½ in. through 2 in. pipe sizes. Each size shall be available in 180° and 360° distribution patterns.
12. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures.

2.2 AGENT

- A. Agent shall physical and chemical properties shall conform to the requirements of NFPA 2001.
- B. The agent shall be stored in pressurized containers. Container pressure shall not exceed 360 psig at 70 degrees F.
- C. The agent shall have the following characteristics:
 1. Ozone depletion potential of zero
 2. Atmospheric lifetime less than 50 years.

2.3 EXTINGUISHING-AGENT CONTAINERS

- A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
 1. Finish. Manufacturer's standard color, enamel or epoxy paint.
 2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
 3. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
 4. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

2.4 CONTROL PANEL

- A. The detection control system and its components shall be UL listed and FM approved for use as a local fire alarm system with releasing device service.
- B. The control system shall perform all functions necessary to operate the system detection, actuation, and auxiliary functions.
- C. The control system shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.
- D. The control system shall be microprocessor based, utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules in the system.
- E. The control system shall be capable of supporting Cross Zoned Detection.
- F. The control system shall supply integrated 2.0 amp (minimum) power supply circuitry.
- G. Each control system shall contain four (4) initiating circuits:
 - 1. a) Each circuit shall be capable of Class A (Style D) or Class B (Style A) operation.
 - 2. b) Each circuit shall be capable of operating up to fifteen (15) approved detectors or thirty (30) detectors per system.
 - 3. c) Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input.
- H. Each control system shall contain release circuits for activation of a fire suppression system(s):
 - 1. a) Each circuit shall be capable of Class B (Style Y) operation.
 - 2. b) Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
- I. Each control system shall contain two (2) indicating appliance circuits for annunciation:
 - 1. a) Each circuit shall be capable of Class A (Style B) or Class B (Style Y) operation.
 - 2. b) Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
- J. Each control system shall provide an auxiliary power supply rated for 2 amps @ 24 VDC.
- K. Each control system shall provide two (2) SPST relays: one for common alarm and one for common trouble. Four (4) additional programmable relays can be added to each control system by adding a relay module.

2.5 DETECTORS

- A. The detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NFPA 72 and include the following types:
 - 1. Ionization Detectors: Comply with UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
 - 2. Photoelectric Detectors: Comply with UL 268, consisting of LED light source and silicon photodiode receiving element.

2.6 MANUAL RELEASE (Electric)

- A. The electric manual release shall be a dual action device which provides a means of manually discharging the suppression system when used in conjunction with the detection system.
- B. The manual release shall be yellow so as not to be confused with building fire alarm pull stations.
- C. The manual release shall be provided with a Lexan cover. The cover shall be provided with a local alarm when the cover is lifted.
- D. The manual release or manual pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
- E. Manual actuation shall bypass the time delay and abort functions and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
- F. Manual release shall be located at each exit from the protected hazard.

2.7 ABORT STATION

- A. The abort station shall be the "Dead Man" type and shall be located next to each manual release.
- B. The abort station shall be supervised and shall indicate a trouble condition at the control panel, if depressed, and no alarm condition exists.
- C. "Locking" or "Keyed" abort stations shall not be permitted.

2.8 AUDIBLE and VISUAL ALARMS

- A. Alarm audible and visual signal devices shall operate from the control panel.
- B. The strobe devices shall be amber, so as not to be confused with the building fire alarm system.
- C. A strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location.

2.9 CAUTION AND ADVISORY SIGNS

- A. Signs shall be provided to comply with NFPA and the recommendations of the equipment provider.
 - 1. Entrance sign: (1) required at each entrance to a protected space.
 - 2. Manual discharge sign: (1) required at each manual release station.
 - 3. Flashing light sign: (1) required at each flashing light over each exit from a protected space.

2.10 SYSTEM AND CONTROL WIRING

- A. All system wiring shall be furnished and installed by the contractor.
- B. All wiring shall be installed in electrical metallic tubing (EMT), or conduit, and must be installed and kept separate from all other building wiring. Follow University standards for conduit and box identification.
- C. All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, and installed parallel and perpendicular to walls and partitions.
- D. The sizes of the conductors shall be those specified by the manufacturer. Color-coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the control panel and the system field wiring shall be made under the direct supervision of a factory-trained representative.
- E. All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Article 725 and Article 760, except as otherwise permitted for limited energy circuits, as described in NFPA 72. Wiring installation shall meet all local, state, province, and/or country codes.
- F. The complete system electrical installation and all auxiliary components shall be connected to earth ground in accordance with the National Electrical Code.

2.11 PIPING MATERIALS

- A. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.

2.12 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106, Grade B; Schedule 40, , seamless steel pipe.
 - 1. Threaded Fittings:
 - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
 - b. Flanges and Flanged Fittings: ASME B16.5, Class 300.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

2.13 VALVES

- A. General: Brass; suitable for intended operation.
- B. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.
- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

2.14 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
 - 1. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
 - 2. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only..

- 3.2 Connect electrical devices to control panel and to building's fire alarm system.
- 3.3 Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire extinguishing system.
- 3.4 Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.

3.5 SYSTEM INSPECTION AND CHECKOUT

- A. After the system installation has been completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.
 - 1. All containers and distribution piping shall be checked for proper mounting and installation.
 - 2. All electrical wiring shall be tested for proper connection, continuity and resistance to earth.
 - 3. The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational at least five (5) days prior to the final acceptance tests.
 - 4. Each detector shall be tested in accordance with the manufacturer's recommended procedures and test values recorded.
 - 5. All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.
 - 6. Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

3.6 TRAINING REQUIREMENTS

- A. Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner's personnel. Each training session shall include control panel operation, manual and (optional) abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

3.7 OPERATION and MAINTENANCE

- A. Prior to final acceptance, the installing contractor shall provide four (4) complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.

3.8 AS-BUILT DRAWINGS

- A. Upon completion of each system, the installing contractor shall provide four (4) copies of system "AS-Built" drawings to the owner. The drawings shall show actual installation details including all equipment locations (ie., control panel(s), agent container(s), detectors, alarms, manual pull station(s) and abort switch(s), etc.), as well as piping and conduit routing details. Show all room or facilities modifications, including door and/or damper installations completed. One (1) copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

3.9 ACCEPTANCE TEST

- A. At the time "AS-Built" drawings and maintenance/operations manuals are submitted, the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the owner and shall not be conducted until the Test Plan has been approved.
- B. The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation and manual actuation, HVAC and power shutdowns, audible and visual alarm devices, and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
- C. A room pressurization test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.
- D. If room pressurization testing indicates that openings exist which would result in leaks and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. THE SUPPRESSION SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS. If the first room pressurization test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurization tests, at no additional cost to the owner, until a successful test is obtained. Copies of successful test results shall be submitted to the owner for his record.
- E. Upon acceptance by the owner, the completed system(s) shall be placed into service.

3.10 SYSTEM INSPECTIONS

- A. During the one-year warranty period, the installing contractor shall provide two (2) inspections of each system installed under this contract. The first inspection shall be at the six-month interval, and the second inspection at the 12-month interval. Inspections shall be conducted in accordance with the manufacturer's guidelines and the recommendations of NFPA 2001.
- B. Documents certifying satisfactory system(s) inspection shall be submitted to the owner upon completion of each inspection.

3.11 WARRANTY

- A. All system components furnished and installed under this contract shall be warranted against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of system acceptance.

3.12 FIELD QUALITY CONTROL

- A. Test and inspect clean-agent extinguishing system according to NFPA 2001, Section "Approval of Installations."
- B. Perform field-acceptance tests of each clean-agent extinguishing system according to NFPA 2001 when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed.
- C. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Report test results promptly and in writing to Owner's representative and authorities having jurisdiction.

END OF SECTION 21 2213

DIVISION 22 PLUMBING

22 0000 General Requirements for Plumbing Systems

- 22 0001 Basic Plumbing Requirements
- 22 0004 Firestopping for Plumbing Systems
- 22 0005 Excavation, Backfill and Surface Restoration

22 0500 Common Work Results for Plumbing

- 22 0513 Electrical Requirements for Plumbing Equipment
- 22 0519 Meters and Gauges
- 22 0520 Common Piping Materials and Methods
- 22 0523 General Duty Valves
- 22 0529 Pipe Hangers and Supports
- 22 0530 Equipment Bases and Supports
- 22 0553 Identification for Plumbing Systems

22 0700 Plumbing Insulation

- 22 0719 Piping Insulation

22 1000 Plumbing Piping and Pumps

- 22 1116 Domestic Water Piping
- 22 1119 Domestic Water Piping Specialties
- 22 1123 Domestic Water Pumps
- 22 1316 Sanitary Waste and Vent Piping
- 22 1319 Sanitary Waste Piping Specialties
- 22 1513 General Service Compressed Air Piping
- 22 1613 Natural Gas House Piping

22 3000 Plumbing Equipment

- 22 3116 Water Softeners
- 22 3436 Gas-Fired Storage Water Heaters

224000 Plumbing Fixtures

- 22 4200 Plumbing Fixtures

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SECTION 22 0001 – BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Plumbing work.
- C. A complete and functional Plumbing system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SCOPE OF WORK

- A. The scope of the Plumbing work includes furnishing, installing, testing and warranty of all Plumbing work shown on the Plumbing drawings and specified herein, including Division 00, Division 01, Division 22 and applicable provisions of other relevant Divisions..

1.4 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “provide,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect’s decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.5 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, ASPE, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.6 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the Plumbing contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the plumbing work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.7 COORDINATION DRAWINGS

- A. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression, Electrical, Technology, Kitchen Equipment and General Contractor ("Coordination Participant") for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings. No work shall be installed or fabricated until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Construction Manager.
- B. Each Coordination Participant shall use the coordination drawings as a baseline to develop drawings of its own work, specifically locating equipment, devices, piping, conduits, structural elements etc.
- C. Each Coordination Participant shall return its drawings to the HVAC contractor. From these the HVAC contractor shall produce the Detailed Coordination Drawings.
- D. Detailed Coordination Drawings: Plans, drawn to scale (1/4" = 1'-0") for all areas of the building including mechanical rooms and kitchen. The following items shall be shown and coordinated with each other, using input from the Participants:
 - 1. Ductwork, including detailed dimensions and elevations for all block wall penetrations.
 - 2. HVAC Equipment and ductwork accessories.
 - 3. HVAC Piping
 - 4. Plumbing Piping, including storm drainage and plumbing vents
 - 5. Fire Protection Piping
 - 6. Kitchen Hoods, Exhaust Fans and associated ductwork
 - 7. Cable Tray
 - 8. Electrical and Technology Conduits 2" and above.
 - 9. Building structural elements

- 10. Suspended ceiling components.
- 11. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures, including pendant fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

1.8 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. Install new water service and piping from the new service as soon as practicable to facilitate water supply for construction purposes. Provide a water meter, piping and hoses bibbs with vacuum breaker at the site as directed by the General Contractor. Protect meter and piping from physical damage and freezing.
- C. Cost of water use for construction is not included in Division 22.
- D. Remove construction water meter and piping when no longer required.

1.9 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. Plumbing work shall be performed by licensed Plumbing Contractors in accordance with requirements of the jurisdiction.

1.10 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the

daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.

- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.11 PAINTING

- A. Refer to Section 099123 Interior Painting.
- B. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 22:
 - 1. Ferrous metal which is no factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
- C. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 9 of the Specifications. All rust must be removed before application of paint.
- D. Finish painting is included in the General Contract except where otherwise required under remodeling work.
- E. Refer to the Cutting and Patching paragraph in this Section for finishing requirements Refer to 017329 Cutting and Patching for finishing requirements related to cutting and patching in exposed locations.

1.12 MISCELLANEOUS EQUIPMENT CONNETIONS

- A. Certain categories of fixtures and equipment, including kitchen equipment, sterilizers, washers, laundry and laboratory equipment, require piping connections and duct connections as shown on the drawings. Equipment will be furnished and set in places by the equipment supplier.

- B. Make all final connections to these fixture and equipment, as indicated and in accordance with the manufacturer's recommendations. All piping connections shall be valved and final connections made with unions.
- C. Fixtures and equipment, unless otherwise noted, will be furnished complete with the basic plumbing supply and waste trim. The trim will generally be furnished "loose" and shall be installed under this work. Countertop sinks furnished "loose" shall also be installed by the Plumbing Contractor.
- D. Provide supplies, supply stops, traps, shut-off valves, fixture drains, continuous wastes and indirect wastes. Provide a pressure regulating valve and a downstream pressure gauge on the dishwasher rinse water supply. Provide a water-hammer arrestor on the system side of each automatic (quick-closing) valve on water supply lines. Items not specifically described elsewhere in these specifications shall be of the same manufacturer as similar items specified in conjunction with the plumbing fixtures.
- E. Supply piping and devices connecting to kitchen equipment, where exposed to view in the finished space, shall be chrome plated and insulation shall be omitted.
- F. Roughing-in drawings shall be obtained for the various fixtures and items of equipment as the time approaches when such information is required; allow a reasonable period, from the time of notice to obtain this information.
- G. Connections to equipment shall be in accordance with manufacturers installation guidelines. Any additional accessories recommended by the manufacturer such as gauges, shut-off valves, unions at connection points, etc., shall be provided by this Contractor.

1.13 EQUIPMENT SELECTION

- A. Refer to Section 13300 Submittal Procedure.
- B. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal: appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series

designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

- D. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- E. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- F. If extensive changes in pipe, or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.14 SHOP DRAWINGS

- A. Refer to Section 13300 Submittal Procedure.
- B. Shop drawings and descriptive information shall be assembled by the Contractor of equipment and materials furnished in his contract, and submitted to the Architect and/or Engineer for review as stated in the General Conditions and Supplementary Conditions. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following Plumbing equipment and materials shall be submitted:
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers and saddles.
 - 4. Valves.
 - 5. Flexible connectors.
 - 6. Gauges.
 - 7. Pipe insulation.
 - 8. Equipment insulation.
 - 9. Supply system specialties.
 - 10. Backflow preventers.
 - 11. Drainage system specialties.
 - 12. Oil interceptor.

- 13. Plumbing fixtures and trim
- 14. Compressed air equipment.
- 15. Water softening equipment.
- 16. Water heating equipment.
- 17. Domestic hot water return balance report.

1.15 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- D. This provision shall not be construed to include maintenance items such as replacing filters, and cleaning strainers after these have been done for final close-out.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

1.16 OPERATING AND MAINTENANCE DATA

- A. Refer to Section 017823 Operation and Maintenance Data.

1.17 OPERATIONS AND ADJUSTMENT OF EQUIPMENT

- A. As each piping system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing the domestic hot water return system,
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.18 DEMONSTRATION AND TRAINING

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 22 Sections for requirements.

- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 8 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION– NOT APPLICABLE

END OF SECTION 22 0001

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SECTION 22 0004 – FIRESTOPPING FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestopping systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 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: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for ducts on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 22 0004

SECTION 22 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for utility trenches.
2. Excavating and backfill for in ground tanks provided by Division 22.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade, under-floor piping, underground, exterior piping, underground tanks and incidental work which are included in the Plumbing contract. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 22 0002.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Course: Naturally or artificially graded natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Trenches for interior and exterior piping shall be over-excavated and the pipe shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or compacted, crushed limestone, 3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the piping. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.
- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Fiberglass tanks shall be backfilled in accordance with tank manufacturer's instructions. The tank shall be set on a 12" deep bed (between the bottom of tank and the top of the concrete anchor pad or, if no pad, the bottom of the excavation) of washed pea gravel, 1/8" to 3/4" diameter. Backfill around and immediately above the tank shall also be pea gravel.
- F. Concrete floor slabs, paving, sidewalks, curbs sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced but this Contractor equal to original conditions. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.
- G. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- H. All exterior underground piping shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6' wide with black letters identifying the piping service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the pipe.

END OF SECTION 22 0005

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SECTION 22 0513 - ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for Plumbing equipment including 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 and other electrical equipment, devices, fuses, wire, conduit and installation methods.

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.
- B. Refer to the Plumbing drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.3 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 Motors

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Motors for other than general duty application shall be furnished to suit the application and operating environment.

- C. Premium efficiency motors shall be equal to Century “E + 3”, General Electric “Energy Saver Premium Efficiency”, Baldor “Super E Premium Efficient” or Reliance “Premium Energy Efficient” series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- D. Motors used with variable frequency controllers shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31 and designed with Class F or H insulation, but with a Class B temperature rise.
- E. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve.
- F. The Plumbing Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the selected equipment requires revision of the electrical, added cost must be borne by the Plumbing Contractor.

2.2 STARTERS

- A. Magnetic starters shall comply with provisions of Division 26 - Electrical Specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115 volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to insure standby operating capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Plumbing Contractors.

END OF SECTION 22 0513

SECTION 22 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gauges.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Thermometers shall be 9" blue reading organic spirit filled tube column type with cast aluminum case with epoxy finish, acrylic window, aluminum scale with white background and black markings, 1% accuracy, adjustable angle hinge assembly and 3.5" aluminum insertion stem, equal to Trerice BX91403.
- B. Thermometers shall be 5" diameter dial face bi—metallic type with adjustable angle hinge, stainless steel insertion stem and recalibration feature, equal to Trerice B85604.
- C. Provide a separable socket insertion thermowell shall be furnished with each thermometer. An extension neck, with appropriate increase in thermometer stem length, shall also be furnished where insulation thickness exceeds 2".
- D. Ranges of thermometers shall be selected from standard Fahrenheit scales to be consistent with anticipated temperatures, typically 0 deg.F.- 160 deg.F.

2.2 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tupe type with 4-1/2" dial and cast aluminum case, equal to Trerice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces peer sq. in. or 0-5 psi, as appropriate, shall be equal to Trerice 860.

- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, equal to Trerice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.3 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers shall be installed where shown on the drawings and also at:
- B. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at:
- C. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
- D. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position

END OF SECTION 22 0519

SECTION 22 0520 – COMMON PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Dielectric fittings.
 - 2. Sleeves.
 - 3. Escutcheons.
 - 4. Grout.
 - 5. Piping Systems - Common Requirements.
 - 6. Equipment installation requirements common to equipment sections.

1.2 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.
- D. All pressure piping systems regulated by the Ohio Pressure Piping Systems Code, Chapter 4101:8 shall conform to applicable requirements of the Code. Welders shall carry a current State of Ohio, Pressure Piping Board Certification. Each welder shall submit a copy of their signed performance qualification record to the Engineer for approval prior to beginning work on any pressure piping system.
- E. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 DIELECTRIC CONNECTORS

- A. A dielectric connector shall be incorporated at each connection between ferrous and copper piping. Connectors shall be:

1. Dielectric coupling with non-conductive polymer liner, Lochinvar Corp. "V-line" Dielectric fitting on services 180 degrees and less.
2. Dielectric flange with non-metallic bolt hole grommets and gasket.
3. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.2 SLEEVES

- A. Schedule 40 black steel pipe or 18 gauge galvanized steel poured concrete floors, walls and roof decks.
- B. 26 gauge galvanized sheet or Schedule 40 black steel pipe in the other than poured concrete.
- C. Combination pre-set floor sleeve and firestopping assembly equal to Hilti CP 680.
- D. Concrete curbs may be formed and poured around multiple pipe risers in rooms with waterproofing floor membrane, in lieu of the Smith 1720 riser sleeve and clamping ring. Curbs shall be 4" wide x 4" high with chamfered corners. Membrane and curbing shall be arranged to maintain the integrity of the membrane. Pipe sleeves shall be as described for normal areas or extended to the top level of the curb where the concrete is full depth throughout the curbed area.
- E. Piping and conduits extending thru the roof may be fitted with a manufactured pipe curb weatherproofing assembly equal to Pate pca, Ipca and mpca as an alternative to riser sleeves with clamping rings specified above.

2.3 ESCUTCHEONS

- A. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings or overhead structure.

2.4 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 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. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burrs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping adjacent to equipment and specialties to permit servicing and maintenance.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install piping to allow application of insulation.
- L. Select system components with pressure rating equal to or greater than system operating pressure.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- O. Verify final equipment locations for roughing-in.

3.2 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping 2-1/2" and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.3 PIPE SLEEVES

- A. Pipe sleeves, floor and wall openings, water protective curbing and escutcheon plates shall be provided as described below. Pipe sleeves shall be placed in all floor slabs, poured concrete roof decks, walls and partitions, except as noted below, to allow new piping to pass thru and allow for expansion, contraction and normal movement of the pipe. Sleeves are also required for all existing piping related to the various trades in new walls, partitions, floors and roof slabs, same as for new piping.
- B. Sleeves are not required in the following:
 1. In floor slabs on grade.
 2. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 3. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions.
 4. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
 5. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after pipe are set.
- C. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass thru the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well. Refer to the following paragraph for qualification and exceptions relating to firestopping.
- D. Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.

- E. Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- F. Where uninsulated pipes requiring no pipe sleeves pass thru non-fire rated floor, wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

3.4 Mechanical Seals

- A. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 0520

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SECTION 22 0523 – GENERAL DUTY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Check valves.
3. Gate valves.
4. Balancing-Shutoff valves.

B. Related Sections:

1. Division 22 Plumbing piping Sections for specialty valves applicable to those Sections only. Section 22 0553 "Identification for Plumbing Systems" for valve tags and schedules.
2. Valves for natural gas, compressed air vacuum systems are specified in the system specification. See appropriate Division 22 specification.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Sweat end valves of equal construction and features are acceptable in lieu of those specified with screwed ends. Valves of equal construction and features with ends compatible with mechanical joint couplings are acceptable on such systems, and may be manufactured by the coupling system manufacturer. Grooved end valves shall conform to ANSI/AWWA Standard C-606.
- D. Ball valves in piping which is to be insulated shall have extended shaft necks to accommodate the insulation.
- E. All valve for Domestic potable water systems (cold, hot hot return, etc.) shall be “lead free” in accordance with the Federal Safe Water Act (S3874) definition and NSF/ANSI-61 approved

PART 2 - PRODUCTS

- 2.1 Refer to valve schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Drain valves shall be the same as for the shut-off service. Provide a $\frac{3}{4}$ " hose thread adapter on the outlet of each drain valve that is not piped to a drainage point. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- B. Internals shall be removed and the remaining elements of sweat end valves shall be protected against heat damage during soldering or brazing
- C. Valves shall be installed with the stem at or above the centerline of the pipe. Valves shall be located to be accessible for operation, servicing and/or removal.
- D. Packing glands shall be tightened before placing the valves in service.

END OF SECTION 22 0523

SECTION 22 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Hanger Rods and Attachments.
 - 5. Pipe Riser Supports

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design seismic-restraint hangers and supports for piping and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
1. General service - clevis type - Fig. 260.
 2. Uninsulated copper tubing - copper plated clevis type - Fig. CT-65 (or plastic coated clevis, or fiberglass construction).
 3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Fig. 181, shall be used to allow for expansion travel
- B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
 2. Pipe 2-1/2" and larger – wood blocking to prevent crushing insulation, with Anvil Fig. 168 18 ga. Sheet metal rib-lock shield with belled ends, 12" long.
- C. The first two hangers on piping connecting to motor driven equipment shall be fitted with a steel spring and neoprene vibration isolation section similar to Mason Industries, No. 30N.

2.2 TRAPEZE HANGERS

- A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below or matching manufacturer's provisions. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"
4" to 6"	1/2"

B. Hanger rod attachment devices for attachment to the structure shall be:

1. Pre-set concrete inserts.
2. After-set steel expansion type concrete inserts.
3. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
4. Side beam bracket for wood construction equal to Anvil Fig. 206.
5. Channel support system equal to Unistrut or Hilti.

2.4 PIPE RISER SUPPORTS

A. Riser clamps on cold service insulated piping shall be:

1. Insulated Pipe size 1-1/2" and smaller shall be factory (Pipe Shields E1000) or shop fabricated assembly Fig. 261 with high density calcium silicate insulation and galvanized steel jacket.
2. Insulated Pipe size 2" and greater shall be factory fabricated assembly Pipe Shields, Inc. E1000.
3. Un-insulated copper tubing – Anvil Fig CT-121 or CT-121C
4. Un-insulated steel piping – Anvil Fig. 261.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing of hangers shall be as follows:

1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft.. intervals.
3. Cast iron pipe - Vertical
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
4. Cast iron pipe – Horizontal
 - a. At 10 ft. intervals.
 - b. Support each length of pipe not more than 18" from the joint.

- c. Support terminal ends of horizontal runs and branches and each change in direction.
 - d. 5" and larger provide bracing to prevent horizontal movement in accordance with CISPI "Soil Pipe and Fittings Handbook"
- 5. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.
- 6. Copper Tubing – Horizontal
 - a. 1-1/4" size and smaller – 6 ft. intervals
 - b. 1-1/2" thru 2" – 8 ft.. intervals
 - c. 2-1/2" and larger – 10 ft. intervals
- 7. Plastic pipe
 - a. Per manufacturer's recommendations.
- B. In piping systems with mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Vertical piping shall be supported at normal specified intervals or every other pipe length, which ever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
 - 1. Pre-set concrete inserts in concrete construction of 4" minimum depth.
 - 2. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 - 3. Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
 - 4. Unistrut channels with spring and nut rod connection may be utilized where a number of pipes are run parallel. Channel shall be attached to the structure with inserts or clamps.
 - 5. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel deck with concrete slab poured deck. Refer to 1 and 2 above.
- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturers recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.

- F. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within the pipe chase. Insure that adequate support is still maintained.
- G. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.
- H. Pipe supports manufactured by Advanced Support Products for pipe running across the roof shall be installed in accordance with the manufacturer's instructions and as detailed. Install protective slip sheets of roofing membrane under the bases to satisfy requirements of both the roofing manufacturer and the support system manufacturer.

END OF SECTION 22 0529

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SECTION 22 0530- EQUIPMENT BASES AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Equipment Supports
- B. See Division 22 Section "Vibration Control" for vibration isolation devices.
- C. See Division 22 Section "Seismic Control for Plumbing Systems".

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint equipment support and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Equipment hangers and supports.
 - 2. Equipment bases.
 - 3. Support Curbs.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete bases and pads with anchor bolts cast-in-place. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.

2.2 STEEL SUPPORTS

- A. Structural steel angles, beams or channels, unistrut type channels or pipe. Supports shall be fabricated into a rigid framework with welded or bolted connections and cross-bracing or sway bracing. Supports shall be set on slab with base plates, or attached to the building structure as required. Brackets for relatively lightweight equipment may be attached to the wall. Equipment shall be set on and attached to the framework.
- B. Solid steel hanger rods supported from the structure above similar to pipe hangers. Provide sway bracing for equipment supported in this manner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete bases for plumbing equipment are included in the Plumbing Contract. The Plumbing Contractor shall provide exact dimensions, locations and other detail for the specific equipment provided. The Plumbing Contractor shall set anchor bolts as required for the equipment.

END OF SECTION 22 0530

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Warning markers.
4. Valve Tags

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include water heaters, pumps, tanks, air compressors, ... and other similar equipment.
- B. Labeling shall be:
1. Permanently attached engraved brass or plastic laminated signs with 1" high lettering. Signs on exterior equipments shall be brass.
 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:

1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.
2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1-1/2" wide, full circle at both ends of the marker.
3. Arrows for direction of flow provided integral with the pipe marker or separate at each marker.

2.3 WARNING MARKERS

- A. Underground line marker tape shall be permanent bright-colored, plastic with continuous identification lettering. Tape over service lines that cannot be detected by a metal detector shall be multi-ply with an aluminum foil core.

2.4 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be polished brass or plastic laminate with solid brass S hook. Tags shall be engraved with "P" for Plumbing and the designated number.

2.5 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.

- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 22 0553

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SECTION 22 0719 - PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Flexible Elastomeric.
2. Protective Jacketing

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- B. Thicknesses shall be in compliance with ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Refer to insulation schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with manufacturer's recommendations.
- B. Overlap and seal all longitudinal joints. Staples and adhesive may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal.
- C. Where insulation is terminated, insulation shall be beveled at 45 degrees and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- D. Mechanical joint fittings and couplings shall be considered as a part of the pipe line and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- E. Insulation on cold service piping shall be run through floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to Section 22 0529 for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. Coordinate with the contractor on the furnishing, installation and detailed requirements of these. Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.
- F. Verify that piping has been tested before applying insulation materials and that piping surfaces are clean and dry, with foreign material removed.
- G. Fittings, valves, flanges and other devices, both exposed and concealed, requiring insulation shall be covered same thickness as pipe insulation with:
 - 1. Factory molded fitting insulation cover with PVC one-piece fitting cover.
 - 2. Miter-cut segments of pipe insulation, held in place with adhesive and/or wire, filled with insulating cement smoothed to shape and covered with PVC one-piece fitting cover.
 - 3. Fiberglass blanket insulation, held in place and covered with PVC one-piece fitting cover.
 - 4. Oversized pipe insulation, where applicable, finished same as straight run pipe insulation.
- H. Underfloor direct buried domestic hot water and domestic hot water recirculating pipe and fittings shall be insulated with 1" flexible elastomeric insulation. Fittings need not be insulated.
- I. Sanitary drainage piping receiving condensate from air handling unit cooling coil drain pans including- floor drain sump, trap and horizontal above ground piping to the vertical stack or to the downstream horizontal piping main shall be insulated with 1" thickness.

END OF SECTION 22 0719

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Valves Schedules
3. Unions and Flanges.
4. Dielectric Connectors.
5. Pipe Sleeves
6. Escutcheons.

1.2 SUBMITTALS

A. Product Data: For each type of product used.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIAL

- A. Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

2.2 UNIONS AND FLANGES

- A. Unions on copper tubing, all bronze construction 150 lb., solder ends.
- B. Unions on steel pipe 2" and smaller, malleable iron with ground seat, bronze to steel, 300 lbs., screwed ends.

- C. Flanges on steel pipe with welded or screwed joints, 2-1/2" and larger. Gaskets shall be 1/16" thickness full face compressed sheet suitable for temperature and pressure ranges of the application.
- D. Mechanical joints associated with grooved end pipe are acceptable in lieu of unions and flanges.

2.3 DIELECTRIC FITTINGS

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.

2.4 PIPE SLEEVES

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for basic piping installation requirements.
- B. Piping shall be pitched for drainage. The low points shall be fitted with a 3/4" drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4" and smaller where a drain valve is not shown, a drain plug is acceptable. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- C. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- D. Piping shall be supported as specified in Section 22 0529 Pipe Hangers. Piping with mechanical joints for grooved end pipe shall be supported in accordance with the manufacturer's recommendations. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- E. Inform the Insulation sub-contractor during the bid period as to the extent of use of mechanical joints so that sub-contractor can price the work accurately.
- F. Internals of sweat end valves shall be removed when damage or warping could occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be used to reduce the danger of damage. Close open ends of piping during installation to keep interior of the pipe clean.
- G. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2" and larger.

- H. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed.
- I. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.
- J. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- K. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- L. Refer to drawings for seismic-restraint requirements
- M. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- N. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 FIELD QUALITY CONTROL

A. Piping Inspections:

- 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Piping Tests:

- 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- 2. 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.
- 3. 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.

4. Domestic water piping – hydrostatic at 125 psig for 6 hours at the low point of the system. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

C. Domestic water piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 PIPE CLEANING

- A. Before placing each water piping system in operation, the piping system shall be thoroughly flushed out with clean water.

3.4 DISINFECTION OF PIPING

- A. All new domestic water piping shall be disinfected by a company or personnel regularly engaged in the performance of this service.
- B. Fire suppression water piping supplied from a potable water system shall also be disinfected if the potable water systems, both public and private, is not protected by a double check valve assembly or reduced pressure backflow assembly.
- C. Disinfection shall be performed in accordance with AWWA C651- 86 Standards. Disinfection shall be means of a chlorine solution injected into the water system near the source. Outlets throughout the system shall be tested to prove presence of minimum chlorine concentration. Flush out the system with clean water until the residual chlorine content is not greater than .2 parts per million or until approved by the Health Department.
- D. Disinfection procedures shall be witnessed by the Architect, Engineer or other qualified representative.

3.5 DOMESTIC HOT WATER RETURN SYSTEM BALANCING

- A. The plumbing contractor shall engage the services of an AABC or NEBB certified balancing contractor to balance and prepare a balance report for the domestic hot water return system(s)
- B. The domestic hot water return shall be balanced and or adjusted to provide proper operation or function in accordance with the drawings, specifications and manufacturer's recommendations.
- C. Submit balance report. Report to include:
1. Project name and location.
 2. Balancing firm name and address.
 3. Architect's name and address.
 4. Engineer's name and address.
 5. Contractor's name and address.
 6. Report date.

7. Location and information data for each recirculation pump.
8. Location and information data for each balancing valve.
9. Pump design and final pump performance settings.
10. Balance valve design and final valve settings.
11. Notes to explain why final data varies from indicated values.

END OF SECTION 22 1116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Drain valves.
9. Water hammer arresters.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: 3/4" to 3", as required to match connected piping or as noted on drawings.
6. Body: Bronze for 2" and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2" and larger.
7. End Connections: Threaded for 2" and smaller; flanged for 2-1/2" and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2-1/2" and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: 3/4" to 3", as required to match connected piping or as noted on drawings.
6. Body: Bronze for 2" and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2" and larger.
7. End Connections: Threaded for 2" and smaller; flanged for 2-1/2" and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2-1/2" and larger.

C. Backflow-Preventer Test Kits

1. Manufacturers Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.

- c.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1003.
 - 3. Pressure Rating: Initial working pressure of 150 psig.
 - 4. Size: 1/2" to 3", as required to match connected piping or as noted on drawings.
 - 5. Body: Bronze for 2" and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2" and 3".
 - 6. End Connections: Threaded for 2" and smaller; flanged for 2-1/2" and 3".

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Emergency Fixture Thermostatic Mixing Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley Corporation
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
 - f. Guardian Equipment
- 2. Standard: ASSE 1071.
- 3. Pressure Rating: 125 psig.
- 4. Type: Exposed-mounting type, thermostatically controlled water mixing valve.
- 5. Material: Bronze body with corrosion-resistant interior components.
- 6. Connections: Union inlets and outlet.
- 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, thermometer on outlet, temperature-control handle.
- 8. Tempered-Water Setting: 85 deg F .
- 9. Tempered-Water Design Flow Rate: 20 gpm(showers)/.4gpm(eyewash) gpm.
- 10. Valve Finish: Rough bronze.
- 11. Piping Finish: Copper.

B. Point of Use Thermostatic Mixing Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradley Corporation
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
- 2. Standard: ASSE 1070.
- 3. Pressure Rating: 125 psig.

4. Type: Exposed-mounting type, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, thermometer on outlet, temperature-control handle.
8. Tempered-Water Setting: 105 deg F .
9. Tempered-Water Design Flow Rate: 0.5 gpm minimum.
10. Valve Finish: Chrome plated
11. Piping Finish: Chrome plated where exposed to view.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers.

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for 2" and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for 2-1/2" and larger.
3. End Connections: Threaded for 1/2" and smaller; flanged for 2-1/2" and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers 2" and Smaller: 0.020 inch.
 - b. Strainers 2-1/2" to 4": 0.045 inch.
6. Drain: Pipe plug.

2.6 HOSE BIBBS

A. Interior Exposed Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: 3/4" threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze.
9. Finish for Service Areas: Chrome / nickel plated.
10. Operation for Equipment Rooms: Wheel handle.
11. Operation for Service Areas: Wheel handle.
12. Operation for Finished Rooms: operating key.
13. Include operating key with each key operated hose bibb.
14. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. Nonfreeze Wall Hydrants :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Woodford Manufacturing Company.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig .
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: 3/4".
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Include operating key with each key operated hose bibb

2.8 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: 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.

2.9 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. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
 3. Type: Copper tube with piston.
 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve, and pump.
- G. Install water hammer arresters on each quick closing valve in water piping according to PDI-WH 201.

- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- I. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer and/double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic hot-water recirculation:

- 1. Close-coupled, in-line, seal less centrifugal pumps.

1.2 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
 - 2. Casing: Bronze, with threaded companion-flange connections.
 - 3. Impeller: Corrosion-resistant material.
 - 4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Electrical Requirements for Plumbing Equipment."
- B. Capacities and Characteristics:
 - 1. Capacity: Refer to Drawings.r

2. Total Dynamic Head: Refer to Drawing for
3. Maximum Operating Pressure: 125 psig.
4. Maximum Continuous Operating Temperature: 220 deg F .
5. Inlet and Outlet Size: Refer to Drawings
6. Motor Horsepower: Refer to Drawings
7. Electrical Characteristics: Refer to Drawings

C. Acceptable Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Taco, Inc.

2.2 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion sensor, for installation in hot-water circulation piping.
2. Range: 50 to 125 deg F.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Settings: Start pump at 115 deg F and stop pump at 120 deg F.
7. Acceptable Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.

B. Timers: Electric time clock for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: Suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.
7. Acceptable Manufacturers:
 - a. Honeywell International, Inc.
 - b. Intermatic, Inc.
 - c. Johnson Controls, Inc.
 - d. TORK.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install in-line, seal less centrifugal pumps with motor and pump shafts horizontal.
- E. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- F. Install timers on wall in mechanical room.
- G. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to pumps to allow service and maintenance.
- I. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping.
 - 2. Install test plugs for pressure gage at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and test plugs.
 - 3. Install thermometer at suction of pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometer.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- L. Connect timers to pumps that they control.

END OF SECTION 22 1123

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product used.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast iron pipe, fittings, and standard duty no-hub couplings shall be listed by NSF International and marked with "NSF" demonstrating certification.
- C. Plastic piping and components shall comply with NSF 14, "Plastics Piping Systems Components and Related Materials,". Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. Basic piping installation requirements are specified in Division 22 Section ""Common Piping Materials and Methods. "
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section " Common Piping Materials and Methods."
- D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. On piping 5" and larger provide bracing at every branch opening or change in direction as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Piping suspended 18" or more shall be provided with sway bracing as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. 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.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping smaller than 3" and; 1 percent downward in direction of flow for piping 3" and larger.
 - 2. Vent Piping: slope down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

- L. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- M. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- N. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- O. Refer to drawings for seismic-restraint requirements
- P. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- Q. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 JOINT CONSTRUCTION

- A. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code or indicated on the drawings.
 - 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. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2" and larger.

3.4 FIELD QUALITY CONTROL

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- B. 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.
- C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.5 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. Plugs the ends of uncompleted piping at end of day and when work stops.

3.6 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 1316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Floor drains shall be as indicated on the drawings:

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. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Wade Manufacturing Company Division of Tyler Pipe

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Manufacturer shall be same as floor drains.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: As required to match connected piping.
5. Closure: Raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Maintenance Device:

1. Description: Device inserted into the drain body or adjustable strainer that opens to allow water to pass thru and closes to prevent sewer gases from entering the room from the drainage system.
2. Must conform to ASSE 1072 .
3. Size: Same as floor drain outlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to 4". Use 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 4" and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 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.

- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install vent caps on each vent pipe passing through roof.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft, 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

- 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

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SECTION 22 1513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.
- B. Compressor, receivers and accessories are provide by the owner. The plumbing contractor shall provide a concrete pad and install these items.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Air Compressor package including wiring diagrams for power, signal, and control wiring.
 - 2. Pressure regulators. Include rated capacities and operating characteristics.
 - 3. Automatic drain valves.
 - 4. Filters. Include rated capacities and operating characteristics.
 - 5. Lubricators. Include rated capacities and operating characteristics.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 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 1 and UL 508.

1. Enclosure: NEMA ICS 1, control panel unless otherwise indicated.
 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage 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. Aftercooler with moisture separator.
 7. Low oil pressure switch.
 8. Instrumentation: Include discharge-air pressure gage, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
 9. Alarm Signal Device: For connection to alarm system to indicate when oil pressure is low.
- 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, pressure-reducing valve, and electric tank drain.
- D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with vibration isolators and reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.2 PIPES, TUBES, AND FITTINGS

- A. Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

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, 2" and Smaller: Threaded steel pipe nipple.
 3. End Connections 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 if wall mounting is indicated.
- E. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

2.5 UNIONS AND FLANGES

- A. Unions on copper tubing, all bronze construction 150 lb., solder ends.
- B. Unions on steel pipe 2" and smaller, malleable iron with ground seat, bronze to steel, 300 lbs., screwed ends.
- C. Flanges on steel pipe with welded or screwed joints, 2-1/2" and larger. Gaskets shall be 1/16" thickness full face compressed sheet suitable for temperature and pressure ranges of the application.
- D. Mechanical joints associated with grooved end pipe are acceptable in lieu of unions and flanges.

2.6 PIPE SLEEVES

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

3.2 Equipment Mounting: Install air compressors and aftercoolers on concrete bases using vibration isolators.

- A. Install the following devices on compressed-air equipment:
 1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 2. Pressure Regulators: Install downstream from air compressors.

3. Automatic Drain Valves: Install on aftercoolers and receivers. Discharge condensate over nearest floor drain.
- B. Engage a factory-authorized service representative to 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.

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.
- B. Install piping concealed from view and protected from physical contact by building occupants, 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 otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 1. Use steel companion flange with gasket for connection to steel pipe.
 2. Use cast-copper-alloy companion flange with gasket and brazed[**or soldered**] joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

- J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."
- K. Install piping to permit valve servicing.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.
- O. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- P. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- Q. Refer to the Drawings for seismic-restraint requirements
- R. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- S. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.4 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.
- B. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.5 SPECIALTY INSTALLATION

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.
- F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.

- G. Install hose assemblies at hose connections.

3.6 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.

- B. Tests and Inspections:

1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters and pressure regulators for proper operation.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air compressors and aftercoolers.

END OF SECTION 22 1513

SECTION 22 1613 –NATURAL GAS HOUSE PIPING

PART 1 - GENERAL

1.1 SUMMARY

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. All gas piping work shall be in accordance with Gas Company requirements. Verify materials selected are in conformance before installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Materials and installation shall conform to standards and requirements of the Gas Company and the Ohio Building Code including the referenced International Fuel Gas Code.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 PIPING SPECIALTIES

A. Gas Pressure Regulators:

1. Gas pressure regulator shall be self-operating spring loaded type. Valve body shall be cast iron, 125 psi construction with screwed or flanged connections. Spring and diaphragm casings shall be aluminum. Regulator shall have an internal relief valve assembly, tapped vent connection with removable screen on the spring casing and an external pilot operator to afford a 5% maximum droop. Over-pressure protection shall be ten times the inlet pressure (or higher as may be required by the gas company).
2. Regulator shall be Fisher Type S102 or S202 or equal by Sprague or Equimeter. Refer to the drawings for size, capacity, inlet and outlet pressures and installation detail.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Piping Materials and Methods."
- B. Outdoor Piping
 1. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
 2. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 3. Install underground, PE, natural-gas piping according to ASTM D 2774.
 4. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - b. Replace pipe having damaged PE coating with new pipe.
 5. Install fittings for changes in direction and branch connections.
 6. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 7. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 8. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 22 Section "Meters and Gages.
 9. Piping installed above ground and outdoors shall be painted to protect it from corrosion.
 10. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.
- C. Indoor Piping Installation
 1. Valves, unions and threaded joints are not permitted in inaccessible locations. Valve shall not be located in ceiling air plenums and or other air plenums or ducts.
 2. Comply with Gas Company for installation and purging of natural-gas piping.

3. A shutoff valve and dirt and moisture leg with screwed end cap shall be provided on the pipe drop to each item of equipment.
4. Gas pressure regulators shall be installed in accordance with the manufacturer's instructions. Provide valved gauge taps upstream and downstream of the regulator and a pressure gauge on the downstream side. Provide pilot regulator piping and miscellaneous valves, devices and piping to complete the installation.
5. Vent piping shall be extended individually from each regulator and gas venting device to outside the building in an approved location.
6. Piping installed above ground and outdoors shall be painted to protect it from corrosion.
7. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed.
8. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
9. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
10. Refer to the drawings for seismic-restraint requirements
11. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
12. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.1 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. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.1 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install regulator with maintenance space adequate for servicing and testing.

3.2 CONNECTIONS

- A. Connect to utility's gas service 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. Dirt Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.3 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction. Test pressure shall be 3 psi or 1.5 times the working pressure whichever is greater.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 22 1613

SECTION 22 3116 - WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes commercial water softeners.
 - 1. Chemicals.
 - 2. Water testing kits.

1.2 SUBMITTALS

- A. Product Data: For each type of water softener and water testing kit indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and connections to piping systems.
 - 1. Include wiring diagrams.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.
 - 1. Water Softener, Warranty Period: Five years from date of Substantial Completion.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Salt for Brine Tanks: Furnish same form as and at least four times original load, but not less than 200 lb. Deliver on pallets in 40- or 50-lb packages.
 - 2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

PART 2 - PRODUCTS

2.1 SOFTENER TANK(S)

- A. Each system shall include two (2) tanks. Each The sideshell height shall be sufficient to allow for proper freeboard space above the resin bed for adequate expansion of the resin during backwashing.
- B. Tank(s) shall be manufactured of polyester reinforced by a continuous roving glass filament overwrap. The top opening will be 4" threaded and the tank bottom will be supported on a molded structural base.
- C. The upper distribution system shall be of the single point diffuser type to dispense water laterally to avoid channeling within the resin bed.
- D. The lower distribution system shall be of the single point distributor type, constructed of PVC pipe and a fine slotted strainer to provide even flow distribution through the resin bed. The distribution system shall be embedded in a subfill of washed inorganic material to support the resin bed.
- E. The ion exchange resin shall be virgin high capacity "standard mesh" of sulfonated polystyrene type stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin will be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. The resin shall be solid, of the proper particle size of 20-50 mesh, U.S. standard screen and will contain no agglomerates, shells, plates or other shapes that might interfere with the normal function of the water softener. The resin shall be manufactured to comply with the food additive regulation 21 CFR 173.25 as set forth by the USFDA.

2.2 MAIN OPERATING VALVE

- A. The main operating valve shall be of a top mount design constructed of all plastic inlet and outlet water pipe connections.
- B. The main operating valve will be of the motor driven, electronically activated design with six (6) positions to accomplish the regeneration steps of backwash, brine draw/rinse, fast rinse, brine refill and stand-by, in addition to the service position.

- C. The main operating valve shall incorporate self adjusting flow regulators to control the rate of flow and prevent resin loss during backwash regardless of system pressure fluctuations between 30 and 100 psi.
- D. The main operating valve will be fitted with a fixed orifice eductor

2.3 CONTROLS

- A. A fully integrated programmable microprocessor driven electronic controller shall be provided to automatically cycle the main operating valve through the regeneration sequence. The electronic controller shall be designed and manufactured by the same manufacturer as the water treatment equipment.
- B. The controller shall be capable of initiating a regeneration by accepting an internal signal from the controller time keeping device; an external Hall-Effect flow sensor, a Culligan Aqua-Sensor®, an external device such as a remote start push-button or any combination of these methods. The controller shall sequence all steps of an automatic regeneration and automatically return the softener to a service or stand-by mode. The initiating time and/or volume setpoints shall automatically reset upon completion of the regeneration sequence.
- C. The controller shall include a sealed keypad, capable of programming all controller functions, located on the face of the controller. The controller display shall be a multi-line OLED display capable of full text readouts of operating status and codes. The firmware shall be capable of being updated to the latest version.
- D. An audible alarm beeper capable of emitting a tone of ~70 dBA shall be available but capable of being disabled if so desired.
- E. The controller shall allow for a manual initiation of the automatic regeneration sequence by utilizing a regeneration selection from the controller menu.
- F. The controller shall operate on a low voltage electrical system. The system shall include a UL/CUL listed transformer. The entire electronic control package and its associated inputs/outputs shall require not more than 24 VAC @ 50VA. The control shall be rated for web environments and certified to NEMA 3R.
- G. The controller shall utilize EEPROM to save pertinent programmed data and statistical functions. The controller must retain all functionality for power interruptions of less than 72 hours. A battery backup shall be installed and capable of maintaining the time of day for a minimum of 5 years.
- H. One or a combination of below control options shall be available
 - 1. Timeclock - An operator selected program of a time-initiated reconditioning for single units shall be available. The controller shall be capable of being entirely programmed in the field without additional interface devices. The operator shall be able to select reconditioning to occur after a specified number of hours or days or specific day of the week. The electronic controller shall indicate various data that includes number of reconditionings in the last 14 days, days since last reconditioning, total number of reconditionings for the life of the unit, current day of the week, time of day, and unit in reconditioning.

2. Water Meter - An operator selected volume based reconditioning for single units shall be available. A flow sensor package shall be provided consisting with an appropriately sized installation fitting. The operator shall be able to select reconditioning to occur after a specified number gallons. The electronic controller shall indicate various data that includes number of reconditionings in the last 14 days, days since last reconditioning, total number of reconditionings for the life of the unit, time of day, and unit in reconditioning.
3. Sensor- An operator selected program of immediate or delayed hardness initiated regeneration for single units shall be available. An Aqua-Sensor® control probe will be inserted into the resin bed and will sense the need for regeneration based on electrical impedance within the resin bed and will signal the circuit board to initiate regeneration after a continuous 6 minute increase in impedance ratio. The system will compensate for variations in water hardness and temperature and will require no field adjustments when operated within the normal temperature range of the softener. The controller shall be capable of being programmed in the field without additional interface devices. The controller shall indicate various data that includes number of regenerations in the last 14 days, days since the last regeneration, total number of regenerations for the life of the unit, last slow rinse time, time of day, and unit in regeneration.

I. In addition the following functions shall be provided as part of the system controller:

1. The controller shall have the capability of providing communications with the following external devices:
 - a. Serial Communications (RS-232 & RS-485)
 - b. USB
 - c. Modbus RTU
 - d. Profibus Communications
 - e. BACnet Communications
 - f. Modem (cell modem or land-line modem)
 - g. Dry Contact Alarm Relay
 - h. Wireless Remote (local RF wireless remote, 200 ft range)
- J. Regeneration sequence timers: The controller shall allow control customization of individual regeneration cycle times, each programmable from 1 - 99 minutes. The regeneration cycle and time of cycle remaining shall be displayed when in regeneration.
- K. Lockout function: The controller shall include a lockout to prevent unauthorized personnel from altering program data.
- L. Regeneration override: The controller shall include a function to direct pre-programmed regeneration after a user determined period of time (hours or 24 hour intervals) without an input signal from another regeneration initiation device.
- M. Alarm status indicator: The controller shall monitor operation of internal functions. If a fault is identified, the need for operator intervention will be signaled visually within the controller display.
- N. Two Auxiliary Outputs: Two Auxiliary Outputs shall be integral to the controller circuit board. Each Output shall be capable of being programmed to provide power to a "Normally Open" or "Normally Closed" contact (user choice). These 24VAC outputs shall be used only for the purpose of energizing a relay coil.

- O. Flow rate indication: The controller shall be capable of indicating the flow rate of the treated water.
- P. Totalizer: The controller shall include a totalizer function and a display capacity to 99,999,999 units before resetting to zero. The totalizer value shall be displayed through the controller display during operation.
- Q. The controller shall have the availability to be wall- or remote-mounted for greater accessibility.

2.4 FLOW METER

- A. The main operating valve will include one (1) mechanical turbine-type meter on the outlet side of the water softener. The meter will be directly connected to the cycle timer by a cable. The meter provided shall be the same size as the outlet of the softener. The operating temperature/pressure range of the meter shall be 34°F - 110°F at 120 psi max.

2.5 EXCHANGE RESIN

- A. The ion exchange resin shall be virgin high capacity “standard mesh” of sulfonated polystyrene type stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin will be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. The resin shall be solid, of the proper particle size of 20-50 mesh, U.S. standard screen and will contain no agglomerates, shells, plates or other shapes that might interfere with the normal function of the water softener. The resin shall be manufactured to comply with the food additive regulation 21 CFR 173.25 as set forth by the USFDA.

2.6 BRINE SYSTEM

- A. Provide a complete brine system consisting of a plastic tank, salt platform, salt dosage brine well, an automatic brine valve and all necessary fittings for operation with the water softening system. The system shall consist of a combined brine measuring and salt storage tank with salt platform.
- B. The brine tank will be equipped with a float operated non-corrosive field serviceable brine float valve for automatic control of brine withdrawal and fresh water refill.
- C. The brine valve will automatically open to admit brine to the resin tank during eduction and close automatically providing positive shut-off to prevent air from entering the system. The brine valve will also regulate the flow of soft water into the brine tank during refill. The brine valve works with the timed fill feature of the main operating valve controls to admit the correct volume of fresh water to the brine tank in accordance with the salt dosage setting on the controls. The brine valve will include a float operated safety shut-off valve as a back up to the timed refill from the main operating valve control to prevent brine tank overflow.

2.7 ACCEPTABLE MANUFACTURERS

- A. Northstar
- B. Culligan.
- C. Lakeside.
- D. Aqua Systems
- E. Marlo Incorporated

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for commercial water softeners. Refer to Division 22 Section "Common Work Results for Plumbing."

3.2 WATER SOFTENER INSTALLATION

- A. Install household water softeners on floor. Anchor water softener and brine tanks to substrate.
- B. Install commercial water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
- C. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
- D. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
- E. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
 - 1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

2. Exception: Water softeners with factory-installed shutoff valves at locations indicated.
- E. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."
 1. Exception: Water softeners with factory-installed pressure gages at locations indicated.
- F. Install valved bypass water piping around water softeners.
 1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
 3. Water piping is specified in Division 22 Section "Domestic Water Piping."
- G. Install drains as indirect wastes to spill into open drains or over floor drains.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
- B. Add water to brine tanks and fill with salt.

- C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:
 - 1. ASTM D 859, "Test Method for Silica in Water."
 - 2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
 - 3. ASTM D 1068, "Test Methods for Iron in Water."
 - 4. ASTM D 1126, "Test Method for Hardness in Water."
 - 5. ASTM D 1129, "Terminology Relating to Water."
 - 6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water softeners. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3116

SECTION 22 3436 –GAS-FIRED STORAGE WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following fuel-fired water heaters:

1. Commercial, power-burner, storage, gas water heaters.
2. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

- a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period: From date of Substantial Completion:
 - a. Commercial, Gas Water Heaters: Three years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS WATER HEATERS

- A. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 1. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) 2" and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) 2-1/2" and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 2. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 3. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas fuel.
 - a. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 4. Temperature Control: Adjustable thermostat.
 5. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 6. Special Requirements: NSF 5 construction.

7. Draft Hood: [Draft diverter; complying with ANSI Z21.12] [Insert different hood or other arrangement].
8. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Bock Water Heaters, Inc.
 - b. Bradford White Corporation.
 - c. HESco Industries, Inc.
 - d. PVI Industries, LLC.
 - e. Sellers Engineering Co.
 - f. Smith, A. O. Water Products Company.

2.2 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than 3/4".
- E. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004n or ASHRAE 90.2-2004.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.
 1. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater,

relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.
- F. Install thermometer on outlet piping of water heaters.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect installation, including connections.
- B. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3436

SECTION 22 4200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories showers and sinks.
 - 2. Flushometers.
 - 3. Drinking Fountains
 - 4. Toilet seats.
 - 5. Protective shielding guards.
 - 6. Fixture supports.
 - 7. Disposers.
 - 8. Water closets.
 - 9. Lavatories.
 - 10. Individual showers.
 - 11. Countertop sinks.
 - 12. Service sinks.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities and Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Solid-Surface-Material: ANSI/ICPA SS-1.
 - 2. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flushometer Trim: ASSE 1037.
- F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Supply Fittings: ASME A112.18.1.
 - 11. Brass Waste Fittings: ASME A112.18.2.
- G. Comply with the following applicable standards and other requirements specified for shower valves:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Faucets: ASME A112.18.1.
 - 4. Hand-Held Showers: ASSE 1014.
 - 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.

6. Hose-Coupling Threads: ASME B1.20.7.
 7. Manual-Control Antiscald Faucets: ASTM F 444.
 8. Pipe Threads: ASME B1.20.1.
 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 10. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 4. Manual-Operation Flushometers: ASSE 1037.
 5. Plastic Tubular Fittings: ASTM F 409.
 6. Brass Waste Fittings: ASME A112.18.2.
 7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 3. Flexible Water Connectors: ASME A112.18.6.
 4. Hose-Coupling Threads: ASME B1.20.7.
 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 6. Pipe Threads: ASME B1.20.1.
 7. Plastic Toilet Seats: ANSI Z124.5.
 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 Fixtures and Trim

- A. Refer to the notes/schedule on the drawings for fixture and associate trim specifications.
- B. All waste and supply trim exposed to view shall be chrome plated brass.
- C. Toilet Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats.
 - d. Kohler Co.
 - e. Olsonite Corp.
 - f. Beneke Div, Sanderson Plumbing Products, Inc..
 - g. Sperzel.

2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front with/without cover.
 - c. Size: Elongated .
 - d. Hinge Type: self-sustaining check.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.2 FIXTURE CARRIERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Lavatory Carriers:
 1. Description: Lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include rectangular steel uprights with feet.
- C. Drinking Fountain Carriers:
 1. Description: Carrier with hanger and bearing plates for wall-mounted fixture. Include rectangular steel uprights with feet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install feet and anchor lugs of carriers securely affixed to floor using all bolt holes provided.
- C. Install fixtures level and plumb according to roughing-in drawings.
- D. Attach supplies to supports or substrate within pipe spaces behind fixtures to prevent loose piping fitting piping thru walls. Install -supply stop on each water supply to each fixture connected to water distribution piping. Install stops in locations where they can be easily reached for operation.

- E. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- F. Install toilet seats on water closets.
- G. Install disposer in outlet of each sink indicated to have disposer. The electrical contractor will provide wiring and switch.
- H. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- I. Set showers in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- J. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Adjust flow regulators for proper flow and stream height and adjust water cooler temperature settings for drinking fountains.
- F. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4200

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

23 0000 General Requirements for HVAC Systems

- 23 0001 Basic HVAC Requirements
- 23 0004 Fire Stopping for HVAC Systems

23 0500 Common Work Results for HVAC

- 23 0513 Electrical Requirements for HVAC Equipment
- 23 0525 Flexible Pipe Connectors
- 23 0529 Pipe Hangers and Supports
- 23 0548 Vibration Control
- 23 0553 Identification for HVAC Systems
- 23 0593 Testing, Adjusting and Balancing

23 0700 HVAC Insulation

- 23 0713 Duct Insulation
- 23 0716 Equipment Insulation

23 0900 Instrumentation and Control for HVAC

- 23 0914 Control Wiring and Cabling
- 23 0950 Variable Frequency Motor Controllers (VFD's)
- 23 0993 Sequence of Operations for Controls

23 2000 HVAC Piping and Pumps

- 23 2113 Hydronic Piping

23 3000 HVAC Air Distribution

- 23 3113 Ductwork
- 23 3119 Plenum Casings
- 23 3300 Air Duct Accessories
- 23 3400 Fans
- 23 3713 Diffusers, Registers and Grilles

23 5000 Central Heating Equipment

- 23 5100 Breechings, Chimneys and Stacks
- 23 5523 Gas Fired Radiant Heaters

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SECTION 23 0001 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. All provisions of Book 1 Documents apply to work specified in this Division. Supplemental basic HVAC requirements to these sections are provided in this section.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this HVAC work.
- C. A complete and functional HVAC system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated attics.

1.3 SCOPE OF WORK

- A. The scope of the HVAC work includes furnishing, installing, testing and warranty of all HVAC work shown on the HVAC drawings and specified herein, including Book 1 Documents, Division 23 and applicable provisions of other relevant Divisions.

1.4 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “provide” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of budding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Do not fabricate or deliver ductwork, pipe and fittings in advance of making actual measurements. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated. Provide offsets and minor changes as may be necessary for installation and to maintain required maintenance access spaces.
- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, ductwork or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 110.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect’s decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, dampers and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.5 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.6 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect, the HVAC contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the HVAC work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.7 COORDINATION DRAWINGS

- A. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression, Electrical, Technology, Kitchen Equipment and General Contractor ("Coordination Participant") for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings. No work shall be installed or fabricated until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Construction Manager.
- B. Each Coordination Participant shall use the coordination drawings as a baseline to develop drawings of its own work, specifically locating equipment, devices, piping, conduits, structural elements etc.
- C. Each Coordination Participant shall return its drawings to the HVAC contractor. From these the HVAC contractor shall produce the Detailed Coordination Drawings.
- D. Detailed Coordination Drawings: Plans, drawn to scale (1/4" = 1'-0") for all areas of the building including mechanical rooms and kitchen. The following items shall be shown and coordinated with each other, using input from the Participants:
 - 1. Ductwork, including detailed dimensions and elevations for all block wall penetrations.
 - 2. HVAC Equipment and ductwork accessories.
 - 3. HVAC Piping
 - 4. Plumbing Piping, including storm drainage and plumbing vents
 - 5. Fire Protection Piping
 - 6. Kitchen Hoods, Exhaust Fans and associated ductwork
 - 7. Cable Tray
 - 8. Electrical and Technology Conduits 2" and above.
 - 9. Building structural elements
 - 10. Suspended ceiling components.

11. Items penetrating finished ceiling including the following:

- a. Lighting fixtures, including pendant fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

1.8 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. The use of the permanent HVAC system for temporary heating and ventilation during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period. Provide and maintain temporary air filters to protect coils and ducts. Replace temporary filters with the specified filters (clean) when the systems are placed on permanent duty. Air filters specified for the systems and units, including specified spare filters, are not to be used for temporary service.
- C. Cover all return duct openings with temporary filter media when recirculating air. Stop fans during heavy dust generating operations. Before turning the system over to the Owner, the Contractor shall clean duct interiors and interior surfaces and components with the air handling equipment if dirt, dust and debris have accumulated on these surfaces.
- D. Warranty periods on equipment, materials and system shall commence upon Owner acceptance of the building or system. Temporary heat use shall not jeopardize or alter the warranty requirements.

1.9 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. HVAC work shall be performed by licensed HVAC Contractors in accordance with requirements of the jurisdiction.

1.10 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.

- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.11 PAINTING

- A. Refer to 099123 Interior Painting.
- B. All rust must be removed before application of paint.
- C. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 23:
 - 1. Ferrous metal which is no factory or shop painted or galvanized and which remains exposed to view (interior and exterior) shall be given a prime coat of paint.
 - 2. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
 - 3. Inside of ducts, behind grilles and registers, shall be painted flat black to eliminate the viewing of shiny surfaces.
- D. Finish painting is included in the General Contract except where otherwise required under remodeling work.
- E. Refer to 017329 Cutting and Patching for finishing requirements related to cutting and patching in exposed locations.

1.12 MISCELLANEOUS EQUIPMENT CONNETIONS

- A. Kitchen, laundry and laboratory equipment require duct connections as shown on the drawings. Equipment will be furnished and set in places by the equipment supplier.
- B. Make all final connections to these fixture and equipment, as indicated and in accordance with the manufacturer's recommendations.
- C. Ductwork where exposed to view in the finished space, shall be polished stainless steel unless otherwise indicated.
- D. Roughing-in drawings shall be obtained for the various fixtures and items of equipment as the time approaches when such information is required; allow a reasonable period, from the time of notice to obtain this information.
- E. Connections to equipment shall be in accordance with manufacturers installation guidelines. Any additional accessories recommended by the manufacturer such as gauges shall be provided by this Contractor.

1.13 EQUIPMENT SELECTION

- A. Refer to Section 13300 Submittal Procedure.
- B. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal: appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- D. Substitute equipment of equal quality and capacity will be considered; refer to 013351 Substitution Request Form.

- E. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- F. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.14 SHOP DRAWINGS

- A. Refer to Section 013300 Submittal Procedure.
- B. Shop drawings and descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted for review as required by Section 013300. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following HVAC equipment and materials shall be submitted:
 - 1. Meters and gauges
 - 2. Vibration control
 - 3. Identification for HVAC Systems
 - 4. Duct insulation
 - 5. Equipment insulation
 - 6. Instrumentation and Control for HVAC
 - 7. Ductwork-construction details
 - 8. Plenum casings
 - 9. Air duct accessories
 - 10. Fans
 - 11. Furnaces and Condensing Units

- 12. Diffusers, registers and grilles
- 13. Computer room air conditioner
- 14. Unit heaters
- 15. Radiant Heaters

1.15 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. Provide supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations. This effort shall be considered supplementary to warranty provisions required under Section 017700.
- C. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.
- D. Extended warranties shall be provided where indicated in the equipment specification Sections.

1.16 OPERATION AND MAINTENANCE DATA

- A. Refer to Section 017823 Operation and Maintenance Data
- B. Refer to 23 0923 Direct Digital Control Systems for specific service technician time required for software changes or field adjustments to hardware at the direction of the Engineer for the control system.
- C. As each piping system and air distribution system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems, adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.
- D. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- E. Test relief valves, air vents and regulating valves to insure proper operation.

1.17 DEMONSTRATION AND TRAINING

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 23 Sections for additional requirements.

- B. Refer to 23 0923 Direct Digital Control Systems for specific training requirements for the control system.
- C. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- D. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- E. A minimum of 24 hours shall be allowed for instructions to personnel selected by the Owner; this is in addition to specific demonstration time required for the direct digital control system. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.
 - 4. Separate instructions shall be given by manufacturer's representatives for the temperature control systems.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 23 0001

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SECTION 23 0004 – FIRESTOPPING FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 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: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of

construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. Where required, these shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe or duct at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for ducts or pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.

END OF SECTION 23 0004

SECTION 23 0513 - ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for HVAC equipment including 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 and other electrical equipment, devices, fuses, wire, conduit and installation methods.

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.
- B. Refer to the HVAC drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.3 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 Motors

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Motors for other than general duty application shall be furnished to suit the application and operating environment.

- C. Premium efficiency motors shall be equal to Century “E + 3”, General Electric “Energy Saver Premium Efficiency”, Baldor “Super E Premium Efficient” or Reliance “Premium Energy Efficient” series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- D. Motors used with variable frequency controllers shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31 and designed with Class F or H insulation, but with a Class B temperature rise.
- E. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve except variable speed applications motors shall not be selected to operate in the service range but may be selected based on the duty point.
- F. The HVAC Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the selected equipment requires revision of the electrical, added cost must be borne by the HVAC Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Mechanical Contractors.

END OF SECTION 23 0513

SECTION 23 0525 – FLEXIBLE PIPE CONNECTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Corrugated Metal Pipe Connectors

1.2 SUBMITTALS

- A. Shop Drawings: Provide data for each connector proposed.

PART 2 - PRODUCTS

2.1 CORRUGATED METAL

- A. Corrugated metal pipe connectors shall be constructed of seamless corrugated inner tubing of Type 300 series stainless steel, woven wire braid outer jacket of the same alloy and 150# flanged ends. Rated working pressure shall be safely in excess of the duty imposed. Pipe connectors shall be Minnesota Flexible FFCS or equal by Metraflex or Kinflex.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Flexible pipe connectors and piping shall be installed in accordance with manufacturers' recommendations. Piping shall be aligned (both axially and radially), movement of piping shall be confined and flange spacing set so as to not stress the connector or piping.

END OF SECTION 23 0525

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SECTION 23 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Hanger Rods and Attachments.
 - 5. Pipe Riser Clamps
 - 6. Base Mounted Pipe Supports
- B. See 23 0548 Section "Vibration Control" for vibration isolation devices.
- C. See 23 3113 Section "Ductwork" for duct hangers and supports.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.

PART 2 - PRODUCTS

2.1 PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
 - 1. General service - clevis type - Fig. 260.

2. Uninsulated copper tubing - copper plated clevis type - Fig. CT-65 (or plastic coated clevis).
 3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Fig. 181, shall be used to allow for expansion travel
- B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
- C. The first two hangers on piping connecting to motor driven equipment shall be fitted with a steel spring and neoprene vibration isolation section similar to Mason Industries, No. 30N.

2.2 TRAPEZE HANGERS

- A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"

- B. Hanger rod attachment devices for attachment to the structure shall be:
1. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94.
 2. Channel support system shall be painted steel channel, 15/8"x 15/8"x 12 ga. with elongated holes 2"cc and rolled edges, Power-Strut PS 200 EH or equal by Unistrut or Hilti.

2.4 BASE MOUNTED PIPE SUPPORTS

- A. Base mounted pipe supports shall be as shown on the drawings of materials and finishes indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Spacing of hangers shall be as follows:

1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft.. intervals.
3. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.
4. Copper Tubing – Horizontal
 - a. 1-1/4" size and smaller – 6 ft. intervals
 - b. 1-1/2" thru 2" – 8 ft.. intervals
 - c. 2-1/2" and larger – 10 ft. intervals

- B. In piping systems with rolled groove end pipe and mechanical joint couplings or press fit copper couplings and fittings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Added supports may be omitted on "rigid" couplings such as Victaulic Style 07 Zero-Flex. Vertical piping shall be supported at normal specified intervals or every other pipe length, which ever is more frequent. The base of the riser or base fitting shall be supported.

- C. Attachment of pipe hangers to the structure shall be with:

1. Beam clamps in steel construction Provide anchoring where clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
2. Unistrut channels with spring and nut rod connection may be utilized where a number of pipes are run parallel. Channel shall be attached to the structure with inserts or clamps.
3. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.

- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturers recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.
- F. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.
- G. Exterior pipe supports shall be prime and finish painted for all elements subject to corrosion. Refer to 099123 Painting and Finishing.

END OF SECTION 23 0529

SECTION 23 0548 - VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Vibration Isolators

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate location of vibration isolators.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Combination Spring Neoprene Hanger
1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 2. Housings: Neoprene in shear or double deflection LDS rubber upper and lower elements.
 3. Mason Industries Series "30N"
- B. Neoprene in Shear Hanger
1. Element: Double deflection LDS rubber isolator color coded for load carrying capacity.
 2. Mason Industries Series "HD".
 3. Mason Industries Series "K" or "BMK"

2.2 MANUFACTURERS

- A. Mason Industries.
- B. Kinetics Noise Control
- C. Amber Booth
- D. Vibro Acoustics

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Utilize combination spring/neoprene hangers at support for all motor driven equipment and for piping support for a minimum of two hangers at connection to motor driven equipment.
- B. Utilize neoprene in shear hangers where motor driven equipment is fractional horsepower; utilize combination spring and neoprene hangers for larger motor driven equipment.
- C. Utilize restrained spring with limit stop supports for cooling tower
- D. Utilize neoprene pads for chillers.

3.2 INSTALLATION

- A. Follow manufacturer's instructions in setting and adjusting isolators. Insure that no direct hard surface to surface contact occurs.
- B. Where electrical connections are to be made to equipment mounted on isolators, inform the Electrical Contractor to connect to the equipment with flexible conduits.
- C. See Specification Section 23 0529 Pipe Hangers and Supports for spring hanger locations and hanger installation requirements.
- D. Adjust isolators after piping system is at operating weight.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct Labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include furnaces, condensing units, fans, fan coil unit, energy recovery unit, radiant heaters, electric heaters, unit heaters and other similar equipment.
- B. Labeling shall be permanently attached engraved plastic laminated signs with 1" high lettering.

2.2 PIPE LABELS

- A. Pipe markings shall be applied and labeled as noted to the following piping systems:
1. Refrigerated suction
 2. Refrigerated liquid
- B. Labeling shall be:
1. Pre coiled plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation.
 2. Arrows for direction of flow provided integral with the pipe marker.

2.3 DUCT LABELS

- A. Duct markings shall be applied to all ductwork.
- B. Identification markings shall include service (e.g. supply, return, exhaust, outside air), direction of air flow, and identify what equipment it is served from (e.g. FRN-1, FRN-2, EF-1, etc.) provided integral with duct marker.
- C. Duct markings shall be laminated plastic color-coded pressure sensitive vinyl tape, 2-1/2" width, 3 mil minimum thickness.

2.4 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings. Adhesive only labeling is not acceptable, secure with sheet metal screws. Exhaust labeling shall also indicate service of room or area of service.
- E. Pipe and duct markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces. Pipe labels are required on main piping runs only. Run-outs to terminal units do not require labels unless run-out is over 25 feet in length. Label spacing shall be adjusted to ensure that labels are installed in every room that main piping runs through.
- F. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes Testing, Adjusting and Balancing (TAB) to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems Furnace FRN-1, FRN-2, FRN-3, FRN-4, FRN-5
 - b. Energy Recovery Unit ERV-1
 - c. Exhaust Fans EF-1, EF-2
 - 2. HVAC equipment quantitative-performance settings.
 - 3. Verifying that automatic control devices are functioning properly.
 - 4. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

- A. Strategies and Procedures Plan: 60 days in advance of performing any balancing operation, submit 6 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.3 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing."
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 7.2.2 - "Air Balancing."

- E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.7.2.3 - "System Balancing."

1.4 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.5 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

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.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine new and existing system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- D. Examine system and equipment test reports.
- E. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- G. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- I. Examine strainers for clean screens and proper perforations.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine equipment for installation and for properly operating safety interlocks and controls.
- N. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Sequence of operation for control modes is according to the Contract Documents.
 - 6. Controller set points are set at indicated values.
 - 7. Interlocked systems are operating.
 - 8. Changeover from heating to cooling mode occurs according to indicated values.
- O. Report deficiencies discovered before and during performance of TAB procedures to the HVAC contractor for remediation. 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.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.

7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.
 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with friction fit plastic plugs and patch insulation with new materials identical to those removed. Restore vapor barrier with pressure sensitive tape matching the duct insulation facing.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

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. Crosscheck 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 outside-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. Check for proper sealing of air duct system.

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 fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 PROCEDURES FOR KITCHEN HOODS

- A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.
 1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.
 2. Measure and record the static pressure at the hood exhaust-duct connection.

- B. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.
 - 1. Check duct slopes as required.
 - 2. Verify that duct access is installed as required.
 - 3. Verify that point of termination is as required.
 - 4. Verify that duct air velocity is within the range required.
 - 5. Verify that duct is within a fire-rated enclosure.
- C. Report deficiencies.

3.8 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.9 FINAL REPORT

- A. After completion of the balancing work, a full “pencil copy” report shall be prepared and two copies submitted to the Engineer for review. After review, additional balancing and adjustments, readings and recordings may be required and the report revised. Provide six copies of the final report for review and approval by the Engineer.
- B. The final report shall be computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- C. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- D. Final Report Contents: In accordance with standards established by AABC and NEBB. Include all both actual and design data including:
 - 1. Fan cfm, rpm, brake horsepower, static pressures, motor nameplate data, voltage and amperage data for air systems. Include fan performance curves.
 - 2. Dead head and flow test data, including gpm and pressure, motor nameplate data, voltage and amperage data for fluid systems. Include pump curves.

END OF SECTION 23 0593

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SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
2. Protective Jacketing

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Manufacturers
1. Johns Manville Corporation
 2. Owens Corning Corp.
 3. Knauf Fiber Glass

2.2 SCHEDULE

- A. Refer to duct insulation schedule on the drawings for requirements.
- B. Vent air ductwork between the exterior plenum to the isolation dampers, all supply air (except where noted otherwise) and all outside air intake and as well as all plenums shall be insulated.
- C. Equipment and devices in supply ductwork which could potentially condense moisture shall be insulated. This includes but is not limited to air control dampers, valves and fire dampers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with manufacturer's recommendations.
- B. Blanket insulation shall be wrapped tight to the duct. Insulation shall be secured to ducts 20" wide and greater with weld pins and fasteners, 18" on center maximum. Adhesive shall be applied to the duct as an aid to installation and adhesion. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide FSK pressure sensitive tape.
- C. Board insulation with factory applied jacket shall be secured to the duct with weld pins and fasteners, 12" on center maximum. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide ASJ pressure sensitive tape.
- D. Ductwork which is internally lined with acoustical insulation and flexible ductwork with factory applied insulation need not be further insulated except supply ductwork in unconditioned mechanical spaces shall be insulated as well as lined. Required internal lining is shown on the drawings. Refer to Section 23 3113 Ductwork and coordinate with the various trades.

END OF SECTION 23 0719

SECTION 23 0716 – EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Foam Plastic.

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Thicknesses shall be in compliance with ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 FIBERGLASS INSULATION

- A. Fiberglass pipe insulation – tubular with factory applied “all service” jacket with overlapping longitudinal joints with integral seal.
- B. Vapor barrier jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- C. Manufactures:
 - 1. Johns Manville Corporation
 - 2. Owens Corning Corp.
 - 3. Knauf Fiber Glass
 - 4. Manson

2.3 FOAM PLASTIC

- A. Flexible closed cell foamed elastomeric insulation applied with an air dried, contact adhesive compatible with insulation.
- B. Manufacturers:
 - 1. Armstrong
 - 2. Rubatex
 - 3. Armacell International

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fiberglass pipe insulation shall be applied with sealed overlapping longitudinal joints and, if necessary, secured with staples and mastic. Butt joints shall be sealed with 3” wide ASJ pressure sensitive tape.
- B. Foam plastic insulation shall be held in place with adhesive. All joints shall be sealed with a vapor tight mastic.

END OF SECTION 23 0716

SECTION 23 0914 – CONTROL WIRING AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control wiring, both line and low voltage, transformers, power distribution, fusing and panels, power filtering and communication cabling which is required to perform the automatic control functions described.
- B. Related Sections:
 - 1. 23 0993 Sequence of Operations for Controls

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Wiring, both line and low voltage, shall comply with NEC and shall be subject to approval by the local code enforcing authorities.
- C. Wire, conduit and installation methods shall conform to applicable provisions of Division 26 - Electrical except that wiring smaller than No. 12 and conduit smaller than 3/4" are permitted as appropriate for the application.
- D. All wiring and cabling insulation in air return plenums shall not exceed maximum flame spread rating of 25 and smoke development rating of 50 as established by NFPA 255 test methods.

PART 2 - PRODUCTS

- A. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.
 - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- B. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations or controllers with the following:
 - 1. Minimum dielectric strength of 1000 V.
 - 2. Maximum response time of 10 nanoseconds.

3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.
- C. Power distribution, fusing and panels:
1. Power distribution transformers, fuses, termination strips etc. shall be organized in NEMA 1 enclosure panels. Panels shall be 16 gauge steel construction, with removable front cover and various size removable knockouts, arranged for surface mounting and polyester powder coat finish inside and outside, UL listed. Arrange and bundle wiring inside of panels neatly with cable ties. Panel and internal devices shall be permanently marked to correspond to power wiring diagram shop drawings provided in the operating and maintenance manual.
- D. Cabling:
1. Provide CAT 5E Ethernet fiber optic cabling to interconnect major controllers and work station computer or Web server to establish the primary network configuration as determined by the direct digital control system architecture. Provide excess cabling at each connection for servicing by looping cable near the panel.
 2. Secondary BacNet MS/TP bus wiring to secondary controllers such as unitary controllers serving VAV boxes shall be as required by the communication protocol.
 3. All cabling insulation shall be approved and labeled for use in air plenums where installed in these locations.

PART 3 - EXECUTION

3.1 ELECTRICAL POWER SUPPLIES

- A. Electrical circuits serving direct digital control panels, transformers and other control equipment and devices shall be from the nearest appropriate electrical panel. Note the entire facility will be on emergency power. Electrical contractor will provide an emergency power circuits (quantity as noted on the electrical drawings) to junction boxes in proposed panel locations as shown on the electrical drawings; additional electrical power needs are the responsibility of the Controls Contractor. Coordinate with the Electrical Contractor.
- B. Circuits serving control panels and transformers for low voltage service shall be independent and used for no other purpose. Circuit wiring from the electrical panel shall be included in this contract. These circuits shall be clearly identified at the panels.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." All line voltage wiring and low voltage wiring (except as stated below) shall be run in conduit. Low voltage wiring concealed above accessible ceilings and in

hollow walls for drops to thermostats may be run without conduit. Open wiring dropping into walls shall be run in conduit. Wall temperature sensors, thermostats, etc. shall be installed on a single gang box and conduit shall be installed to extend into the plenum. Open wiring shall be bundled and supported at 3 ft. maximum intervals with a system of J-hooks or equivalent means. Open wiring in air plenums shall be rated for such use and so labeled.

C. Install electronic and fiber-optic cables as follows:

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Cabling concealed above accessible ceilings may be run without conduit. Cabling dropping into walls shall be run in conduit; conduit shall be installed to extend to above an accessible ceiling location. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

END OF SECTION 23 0914

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SECTION 23 0950 - VARIABLE-FREQUENCY MOTOR CONTROLLERS (VFD's) GENERAL

1.1 SUMMARY

- A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFD's) for speed control of three-phase, squirrel-cage induction motors.
- B. VFD's shall be furnished where noted on the drawings or in the specifications. Provide a VFD for each motor.
- C. VFD's shall be furnished by the direct digital controls subcontractor to the Electrical Contractor who will mount the VFD and shall install power wiring required for the installation.

1.2 SUBMITTALS

- A. Product Data: For each type of VFD.
- B. Shop Drawings: For each VFD.
 - 1. Include wiring diagrams.
 - 2. Indicate all accessories required for interface with building automation system for proper operation and control of the motor each drive serves.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- E. Indicate on the VFD submittals that they have been reviewed and coordinated with the direct digital control system to ensure that all necessary components and accessories are included for proper motor operation and control sequence.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. Comply with IEEE Standard 519, Special Applications for Line Notching and Distortion. The manufacturer shall include any additional equipment to meet this requirement, including, AC line filter(s) of the RLC type and/or isolation transformer, or both to meet full compliance.

1.4 COORDINATION

- A. Coordinate features, accessories, inputs/outputs and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB (ACH 550 Series).
 - 2. Yaskawa (E7C Series).
 - 3. Safronics (GP10 Series).
 - 4. Square D (S-Flex Series).
- B. All variable frequency drives required for the HVAC systems shall be from a single manufacturer.

2.2 VARIABLE FREQUENCY CONTROLLERS

- A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
 - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz.
- D. Unit Operating Requirements:
 - 1. Input ac voltage tolerance of plus or minus 10 percent.
 - 2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.
 - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 - 5. Overload Capability: 1.1 times the base load current for 60 seconds; 150 percent peak.
 - 6. Starting Torque: 100 percent of rated torque or as indicated.
 - 7. Speed Regulation: Plus or minus 1 percent.
- E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range with input signal type as coordinated with temperature control contractor as applicable.
 - 1. Electrical Signal: 4 to 20 mA at 24 V or 0-10 VDC.
- F. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 10 percent of maximum rpm.
 - 2. Maximum Speed: 100 percent of maximum rpm.
 - 3. Acceleration: 1 to a minimum of 600 seconds.
 - 4. Deceleration: 1 to a minimum of 600 seconds.

5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
 2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, 150 percent of rated current.
 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 5. Instantaneous line-to-line and line-to-ground overcurrent trips.
 6. Loss-of-phase protection.
 7. Reverse-phase protection.
 8. Short-circuit protection.
 9. Motor overtemperature fault.
 10. Power loss ride-thru (2 seconds).
- H. Automatic Reset/Restart: Attempts no less than three and no more than five restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- I. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- L. Input Line Conditioning: As required to comply with IEEE 519.
- M. VFD Output Filtering: As required to comply with IEEE 519.
- N. Face-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control.
- O. Indicating Devices: Meter(s) or digital readout device(s) and selector switch, mounted on face of controller and connected to indicate the following controller parameters:
1. Output frequency (Hz).
 2. Motor speed (rpm/Hz/percent, selectable).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Elapsed Time Meter (hrs)
 7. Fault or alarming status (code).
 8. PID feedback signal (percent).

9. DC-link voltage (VDC).
10. Set-point frequency (Hz).
11. Motor output voltage (V).
12. KW.

P. Control Signal Interface:

1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC control systems:
 - a. 0 to 10-V dc
 - b. 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
3. Output Signal Interface:
 - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).
4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of any available programmable setting.
5. Embedded communications protocol and interface communications card for LonWorks, BACnet or Ethernet/IP, as required by the temperature control contractor for the direct digital control system provided.

Q. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via the direct digital control system. Provide capability for VFD to retain these settings within the nonvolatile memory.

R. Drive enclosure shall incorporate an integral motor circuit protector circuit breaker or disconnect switch.

S. Manual Bypass: Not required

T. Isolating Switch: Provide load break switch arranged to isolate VFD from supply source with lock-out provisions.

- U. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 ACCESSORIES

- A. Historical Logging Information and Displays:
 - 1. Real-time clock with current time and date.
 - 2. Running log of total power versus time.
 - 3. Total run time.
 - 4. Fault log, maintaining last four faults with time and date stamp for each.

2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to VFD (NEMA 1 enclosure) before shipping.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Provide complete wiring diagrams for use in interfacing with the equipment. Include these diagrams with the shop drawings.

3.2 INSTALLATION

- A. VFD's will be furnished by the HVAC contractor and turned over to the Electrical contractor for mounting.

3.3 IDENTIFICATION

- A. Identify VFD's, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

- A. Power wiring between the electrical distribution panel and the VFD as well as the wiring between the VFD and motor shall be installed by the Electrical Contractor.
- B. Control wiring shall be provided by the temperature control subcontractor.
- C. Bundle, train, and support wiring in enclosures.

3.5 FIELD QUALITY CONTROL

- A. Prepare for equipment start up as follows:
 - 1. Test insulation resistance for each supply and feeder circuit. Ensure that leads are not connected to VFD when meggar testing so as not to damage equipment components.
 - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following for equipment start-up:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Ensure that all accessories, components, motor control parameters and programming capabilities are available and set for the required control sequence and are coordinated.
 - 2. Coordinate the Manufacturer's Field Service Rep site visit to ensure all interested parties are present for equipment startup and verification of all control and setup parameters.

3.6 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate the operation of the variable frequency drive to the Owner's representative and provide complete instruction and training for the equipment. Demonstration shall include the use of bypass switch where provided, interface and control strategies and basic troubleshooting.

END OF SECTION 23 0950

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. All equipment (dampers, actuators, controllers, etc.) required to perform the functions specified shall be provided under this ATC contract unless noted herein or elsewhere in these contract documents.
- C. Electric motor driven equipment (fans, etc.) shall be provided with minimum on (run) and minimum off timers to prevent short cycling of the equipment (coordinate with each equipment manufacturer).
- D. All DDC system control points shall have a default value in case of sensor failure or logic error.
- E. All controlled devices shall fail safe on loss of control.
- F. All set points and parameters shall be fully adjustable and made available to the user on the graphics interface.

1.2 RELATED SECTIONS

- A. Section 23 0914 Control Wiring and Cabling

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXHAUST FANS

Except where noted otherwise, ECM fan motors shall operate at a fixed speed with the ECM potentiometer used for balancing the fan.

- A. EF-1 Kitchen Hood
 - 1. Fan shall operate from hood switch provided by HC (wired by EC) or from rate of rise detector in the hood (parallel wiring). Provide the rate of rise detector and mount in the exhaust duct entry on the top of the hood to turn on if temperature rises to above 125 deg.F (adj.) Fan shall turn off on a fall in temperature to 90 deg.F with a minimum run time of 30 min(adj.)

B. EF-2 Apparatus Bay Exhaust

1. Control fan start/stop and VFD's via apparatus bay door contact closures, CO and NO₂ monitoring system and local manual wall switch. A dry contact will be provided in the server room indicating an apparatus door is open. There will be a dry set of contacts for the bay doors (control for EF-2). Coordinate location and wiring with the EC. On a made contact, start the fan and operate the fan at 50% fixed speed (adj.) for 15 minutes (adj.). Fans shall also start and run at a fixed speed of 40% (adj.) from a wall mounted momentary switch. Fan shall run for a one hour (adj.) in this mode. Fan shall also turn on and run initially at 50% (adj.) speed on a rise in CO, NO₂ level above setpoint in the respective zone. Fan shall ramp up to 100% speed on a rise above threshold level. CO threshold level - 50 ppm (adj.); NO₂ threshold level – 30 ppm (adj.). Fan shall run a minimum of 30 minutes (adj.) in this mode. Fan shall cycle off when the level drops below 25% of the threshold setpoint. Open respective exhaust damper when a fan operates and after a 5 sec. delay, allow the fan to start.
2. Fan (and radiant heater) override pushbutton to turn fan off for 30 minutes (adj.). On a rise over CO or NO₂ threshold as described above, fan to operate as described above (3.1A.1).

3.2 CABINET UNIT HEATERS

- A. EUH-1, EUH-2, EUH-3 and EUH-4 are self contained electric wall heaters with an integral thermostat, no DDC control.

3.3 RADIANT GAS HEATERS

- A. The Apparatus bays include four (4) radiant, indirect gas fired tube heaters RH-1 thru RH-4 with modulating burners. Each two heaters shall be controlled from a space wall temperature sensor (group as RH-1 & RH-2, RH-3 & RH-4). Setpoint shall initially be set to 60 deg. F (adj.)
- B. For RH-1 and RH-2, and for RH-3 and RH-4, provide a momentary wall switch (two – one for RH-1 and RH-2, and one for RH-3 and RH-4) to override and operate the heaters at full capacity for a period of 15 minutes (adj.) for rapid temperature recovery operation.
- C. Radiant Heater RH-1, RH-2, RH-3, RH-4 (and exhaust fan EF-1) override pushbutton to turn fan off radiant heaters for 30 minutes (adj.). On a drop of outside air temperature below 40 deg. F (adj.) radiant heaters to operate as described in sequence above (3.3A).

3.4 APPARATUS BAY UNIT HEATER

- A. Unit heater UH-1 shall operate in conjunction with make up air damper to preheat induced make up air into the apparatus bay on operation of exhaust fans. Enable unit heater when dampers are open. When the damper is open and outside air temperatures are below 40 deg.F (adj.), modulate gas burner in unit heater inversely from outside air temperature, burner at 100% at 0 deg.F ambient temperature and at lowest turndown at 40 deg.F ambient temperature. Burner shall be turned off if any apparatus bay wall temperature sensor is over 75 deg.F.
- B. For UH-1 provide a momentary wall switch to override and operate the heater for a period of 30 minutes (adj.).

3.5 FURNACE SYSTEMS

- A. Furnace systems FRN-1, FRN-2, FRN-3, FRN-4 and FRN-5 with condensing units CU-1, CU-2, CU-3, CU-4, CU-5 – 7-day programmable heating-cooling thermostat with fan on-auto switch, heat-cool-auto switch subbase. Systems to include outside air ventilation dampers set to minimum via mechanical stop based on air balance. Provide a deadband of 4 deg F. between heating and cooling setpoint (adj.)
- B. DOAS Unit ERV-1 – Unit scheduled to run 24/7

END OF SECTION 23 0993

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SECTION 23 2113 –PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes materials and methods for piping. Included in this Section are the following:
 - 1. Pipe, Fittings and Joining Methods.
 - 2. Unions and flanges
 - 3. Pipe sleeves, openings, curbing and escutcheons
 - 4. Installation methods of piping
 - 5. Pipe Testing
 - 6. Pipe cleaning
- B. Refer to other Sections in Division 23 for selection of piping materials for the various services. Piping materials and installation methods peculiar to certain individual systems are specified in Sections related to those systems.

1.2 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe and fittings.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.
- D. All pressure piping systems regulated by the Ohio Pressure Piping Systems Code, Chapter 4101:8 shall conform to applicable requirements of the Code. Welders shall carry a current State of Ohio, Pressure Piping Board Certification. Each welder shall submit a copy of their signed performance qualification record to the Engineer for approval prior to beginning work on any pressure piping system.

1.4 PIPE SLEEVES

- A. Pipe sleeves, floor and wall openings, water protective curbing and escutcheon plates shall be provided as described below. Pipe sleeves shall be placed in all floor slabs, poured concrete roof decks, walls and partitions, except as noted below, to allow new piping to pass thru and allow for expansion, contraction and normal movement of the pipe. Sleeves are also required for all existing piping related to the various trades in new walls, partitions, floors and roof slabs, same as for new piping.
- B. Sleeves are not required in the following:
 - 1. In floor slabs on grade.
 - 2. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 - 3. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions.
 - 4. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
 - 5. In large floor openings for multiple pipe and duct risers which are within a shaft, unless the opening is to be closed off with concrete or other material after pipe are set.
- C. Where pipes penetrate walls and floors other than those required to be fire rated, the annular space between the sleeve, core drilling or opening and the pipe insulation shall be closed to retard the passage of smoke.

PART 2 - PRODUCTS

2.1 See piping systems schedule on the drawings for application.

2.2 PIPE SLEEVES

- A. Schedule 40 black steel pipe or 18 gauge galvanized steel in poured concrete floors, walls and roof decks.
- B. 26 gauge galvanized sheet or Schedule 40 black steel pipe in the other than poured concrete.
- C. Cast iron pipe or Schedule 40 galvanized steel pipe in exterior walls below grade, with intermediate wall stop and anchor collar set in place before concrete pouring. Sleeve shall be a part of the sealing assembly. When the wall opening is core drilled the wall sleeve may be omitted. A mechanically compressed EPDM rubber modular seal assembly providing cathodic separation, reinforced nylon polymer pressure plates and corrosion resistant treated bolts and nuts shall be placed in the annular space between pipe and sleeve or core drilling.

- D. Galvanized sheet metal for existing pipes passing thru new poured concrete floors (18 gauge) and thru new walls and partitions (26 gauge)
- E. Combination pre-set floor sleeve and firestopping assembly equal to Hilti CP 680.
- F. Concrete curbs shall be formed and poured around multiple pipe risers in above grade mechanical rooms. Curbs shall be 4" wide x 4" high with chamfered corners. Pipe sleeves shall be as described for normal areas or extended to the top level of the curb where the concrete is full depth throughout the curbed area.
- G. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings or overhead structure.

PART 3 - EXECUTION

3.1 PIPING

- A. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burrs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- B. Piping shall be pitched for drainage. The low points shall be fitted with a ¾" drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4" and smaller where a drain valve is not shown, a drain plug is acceptable.
- C. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- D. Piping shall be supported as specified in Section 230529 Pipe Hangers. Piping with mechanical joints for grooved end or press fit pipe shall be supported in accordance with the manufacturer's recommendations. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- E. Inform the Insulation sub-contractor during the bid period as to the extent of use of mechanical joints so that sub-contractor can price the work accurately.
- F. Internals of sweat end valves shall be removed when damage or warping could occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be used to reduce the danger of damage.
- G. Piping within 2 ft. of the coil connections to small heating and/or cooling units may be Type "K" soft copper to facilitate connection in a confined space. Joints shall be soldered consistent with the piping system or flared-tubing fittings may be used where appropriate.

- H. Close open ends of piping during installation to keep interior of the pipe clean.
- I. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- J. Bulb wells for temperature sensing specified in Section 23 0913 Instruments and Control Devices shall be furnished by the Control Sub-Contractor and installed by the HVAC Contractor. Other types of control devices (differential pressure switches, flow meters, etc.) shall also be installed by the HVAC Contractor. Devices, fittings (tees, weldolets, threadolets), locations and installation details shall be closely coordinated with the Controls sub-contractor and device manufacturer's instructions.
- K. Automatic control valves shall be furnished by the Controls sub-contractor for installation by the HVAC piping contractor. Flare fittings for flare end valves shall be provided by the HVAC piping contractor.

3.2 UNIONS AND FLANGES

- A. Unions and flanges shall be installed at pipe connections to major equipment and as required for erection purpose. A union shall be installed at each threaded shut-off valve on the side of the valve for which shut-off services intended.

3.3 PIPE SLEEVES

- A. Pipe sleeves shall be placed in the initial stages of construction before concrete, masonry and other general construction activity. Means shall be taken to assure that the sleeve will not move during or after construction. Beams, columns and other structural members shall not be sleeved except upon approval of the Architect.
- B. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass thru the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well.
- C. Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.
- D. Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- E. Where uninsulated pipes requiring no pipe sleeves pass thru non-fire rated floor, wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

3.4 PIPE TESTING AND INSPECTION

- A. All piping provided in this work shall be pressure tested as specified below.
- B. Pipe testing for HVAC piping shall be:
 - 1. Water piping – hydrostatic at 125 psig for 6 hours at the low point of the system, or 1 ½ times maximum operating pressure throughout the system, whichever is higher. Refer to special testing requirements for existing chilled glycol piping at the high school.
 - 2. Condensate drainage piping, same as for plumbing drainage piping.
 - 3. Refrigerant piping – refer to appropriate Refrigeration Sections.
 - 4. Other piping – refer to appropriate Sections.
- C. Testing shall be performed prior to application of insulation. Insure that air is vented from piping when piping is hydrostatically tested.
- D. Tests shall be shall be monitored by a recorder. Test times shall be established at a minimum of 48 hours in advance and notice given to the Architect to allow field representatives of the Architect or Engineer to witness testing if desired. Furnish a written record of each piping system test indicating date, system, pressure, duration and results of tests. Copies of test reports shall be included in the O&M manuals.
- E. Leaks discovered during testing shall not be patched. Threaded connections shall be either tightened or replaced. Small leaks in welded pipe may be chipped and rewelded.
- F. Where a new pipe connects to an existing pipe, provide the following to facilitate testing, cleaning, draining and eventual shutoff service:
 - 1. A shutoff valve in the new pipe near the point of connection.
 - 2. A ¾” valved stub with capped ¾” hose connector beyond the valve for testing of the new pipe extension. Close valve, remove handle after testing is complete. Wire handle to valve body.

3.5 PIPE CLEANING

- A. After hydrostatic tests and repairs are completed and before placing each new piping system in operation the system shall be thoroughly flushed and cleaned, see section 23 2500 for requirements.

END OF SECTION 23 2113

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SECTION 23 3113 - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct materials.
2. Duct liner.
3. Duct connectors.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "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" per the design criteria indicated on the drawings.
- 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 62.1-2004.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation techniques.
2. Factory- and shop-fabricated ducts and fittings.
3. Reinforcement and spacing.
4. Seam and joint construction.
5. Duct Connectors
6. Duct Sealants and Gaskets

7. Penetrations through fire-rated and other partitions.
8. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
9. Hangers and supports, including methods for duct and building attachment and vibration isolation.
10. Duct Labelling

C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. See DUCT CONSTRUCTION AND SEALING schedule on drawings for material specifications.
- B. Ductwork shall be galvanized steel shall be lock-forming, 24 gauge minimum, except as otherwise noted or specified. Galvanize shall be "paint grip" type in exposed areas as noted below.
- C. Stainless steel ductwork shall be No. 304 grade. Joints and seams shall be continuously welded. Ductwork exposed in finished areas shall have No. 4 polished finish on the exterior with welds ground smooth and polished.
- D. Uninsulated duct exposed to view will be painted in the field by the General Contractor. All duct in these areas shall have "paint grip" galvanizing finish.

2.2 DUCT CONNECTORS

- A. Manufactured connectors shall be Ductmate Industries "25 and "35" or equal by Mez Industries or Ward Industries may be used on rectangular ductwork except where welding or brazing is specifically required. Adhere strictly to manufacturers instructions.
- B. Duct connections for round duct branch connection to rectangular sheet metal duct shall be Flexmaster Series FL or equal by Zen Industries or Sheet Metal Connectors, Inc., straight side with and without manual damper, as described on the drawings. Connectors installed on

interior lined rectangular duct shall have an integral insulation guard sleeve. Rectangular tap-to-round branch connection with static boot configuration shall be equal to Flexmaster Type STO.

2.3 SEALANT AND GASKETS

- A. Duct sealant materials shall be United McGill "Water Based Duct Sealer" or equal by Ductmate or Carlisle Hardcast.
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer, except approved, 1500 deg.F. gasket for hood exhaust duct connection to the kitchen hood.

2.4 HANGERS AND SUPPORTS

- A. Refer to details of duct hanger supports on the drawings.
- B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Galvanized-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 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. Size and arrange hangers to provide for continued support upon failure of any individual hanger.
- D. Transverse joints and longitudinal seams shall be assembled with sealant to conform to seal class as noted on the drawings. Selection of sealant materials shall be compatible with the application. Sealants shall be applied in accordance with manufacturer's recommendations.
- E. Attachment of hangers and straps to the structure shall be with:
 - 1. Refer to details on the drawings.
 - 2. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94.
 - 3. Unistrut type channel support system may be utilized.
 - 4. **Attachment to steel deck is prohibited.** Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.
 - 5. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturers recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- F. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures. Ductwork shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment in accordance with NEC.
- G. 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.
- H. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- I. Where ducts pass thru mechanical room walls near sound sensitive spaces, wrap all four sides of the opening with barium sulfate loaded vinyl, limp mass barrier material equal to Kinetics Noise Control Inc. Model KNM-100B extending 4" across the wall and duct and pack the annular space with fiberglass as detailed on the drawings to reduce noise transmission through the opening.
- J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials by covering each open end of the duct with visqueen secured with duct tape before the end of each day's work. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

- K. Interior insulating duct liner shall be installed in strict accordance with manufacturer's printed instructions and SMACNA standards. Liner in rectangular duct shall be shop applied with adhesive over 90% of the surfaces and with weld pins. Edges not factory sealed, cut edges and all joints shall be coated and closed with an adhesive-sealant, both in shop fabrication and field assembly. Leading edges shall be protected with metal "Z" or channel nosing where air velocity exceeds 3,000 fpm. Duct liner shall be protected from getting wet or dirty while being transported to the building site, stored on site and after installation.
- L. Coordinate openings required for the passage of ductwork thru walls, partitions, floors and roofs with the General Contractor.
- M. Sheet metal sleeves in conjunction with fire dampers shall be placed in walls and floors to pass ductwork. Floor sleeves shall project 4" above the finished floor in equipment rooms and areas of similar usage, and shall form a waterproof seal. Exceptions shall be at locations where the opening is protected from drainage falling thru by means of concrete curbs or shaft walls. This Contractor shall be responsible for providing 4" high x 4" wide concrete curbs with beveled edges to protect floor openings related to his work in equipment rooms or providing an equal effective waterproofing metal curb, if not specifically included in the General Contract.
- N. Where duct surfaces can be seen thru grilles, registers and diffusers, the inside of the duct shall be coated with flat black paint before the device is installed, to eliminate obtrusive appearances.
- O. Coordinate duct layout carefully with other trades to avoid conflict with structural elements, lighting and plumbing- heating piping. Flattening of ductwork and offsets to fit ductwork in available space is generally shown. In the absence of such, the Contractor shall arrange the ductwork to maintain concealment and allow ceilings and lights to be installed as intended. Do not hang ductwork until possible interference with electrical and mechanical trades have been resolved. Having ductwork fabricated and delivered in advance shall not be justification for interference with other trades.

END OF SECTION 23 3113

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SECTION 23 3119 - PLENUM CASINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop and field fabricated plenum casings for outside, vent and exhaust air systems, including access doors.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Casings shall be fabricated to withstand **2.0"** positive or negative static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot of width.
 - 2. Elevated casings 3' high and larger that are provided with access doors shall have the bottom floor designed to support the weight of a maintenance worker.

1.3 SUBMITTALS

- A. Shop Drawings: Provide construction details including reinforcement, sealing, liner, devices, etc.

1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 GENERAL CASING FABRICATION REQUIREMENTS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 6, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated.
- B. Plenum casings shall be single wall, external standing seam, galvanized metal construction designed for 2" positive and 2" negative construction where indicated on the drawings, except the floor. The floor of the plenum casing shall be stainless steel construction with continuously

welded seams and joints. The stainless steel floor shall be a pan construction, with continuously welded edges turned up a minimum of 12" on all sides that extend up and connect to the galvanized wall. Alternatively, the entire plenum casing can be galvanized construction with a stainless steel pan as described extending across the entire floor of the plenum.

- C. Metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- D. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M, G90 finish.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. Black steel may be used on the exterior of the plenum only; all interior metal shall be stainless steel or galvanized sheet metal as described. All fasteners, joints, threads, etc. where the galvanizing has been removed shall be cold galvanized in the field.
- F. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections and abutments.
- G. Penetrations: Seal all penetrations air and water tight. Cover with escutcheons and gaskets, or fill with suitable compound.
- H. Access Doors: Fabricate access doors according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-11, "Casing Access Doors - 2-inch wg."
 - 1. Size: 20" x 54" except smaller where restricted by plenum size.
 - 2. Hinges: Piano or butt hinges and latches, number and size according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 3. Latches: Minimum of two wedge-lever-type latches, operable from inside and outside.
 - 4. Neoprene gaskets around entire perimeters of door frames.
 - 5. Doors shall open against air pressure.
- I. Plenums shall be externally insulated in the field.

2.2 SEALANT MATERIALS

- 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. 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. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

8. Service: Indoor.
 9. Substrate: Compatible with galvanized sheet steel and stainless steel.
- C. 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. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Support plenum casings from the floor or from structural wall and roof elements. Support components rigidly with ties, braces, brackets, and anchors of types that will maintain housing shape and prevent buckling.
- C. Align casings accurately at connections, with smooth interior surfaces.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.3 CLEANING

- A. Comply with Division 23 Section "Ductwork."

END OF SECTION 23 3119

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SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual balancing dampers.
2. Backdraft dampers
3. Fire dampers.
4. Pressure Differential gauges.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

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. Fire-damper installations, including sleeves; and duct-mounted access doors.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MANUAL BALANCING DAMPERS

- A. Balancing dampers shall be single cross-blade up to 12 blade width and in larger sizes, multiple blade type 6" maximum width with opposed blade arrangement. Dampers shall be controlled by a locking quadrant positioner with handle equal to vent fabrics "Ventlock" #641 and for externally insulated ducts #644

2.2 FIRE DAMPERS

- A. Dampers shall be constructed and tested to conform with UL 555 and shall be UL listed.
- B. Dampers shall be dynamic type, folded blade curtain type equal to Ruskin DIBD2 (except as otherwise described) with blades folded in the head of the damper housing, stainless steel spring loaded actuation and shall be equipped with a 165 degree (unless otherwise noted) fusible link. Dampers, both horizontal and vertical installations, shall be spring loaded type. Dampers shall be designed for 4" differential pressure and 2000 fpm with a standard 3"+ frame unless required otherwise by the application. Damper construction shall be galvanized steel in gauges required by UL listing in galvanized ductwork; dampers installed in ducts of other materials shall be connections and 1.5" x 1.5" (min.) retaining angles in accordance with damper manufacturers' instructions, SMACNA and UL. Where there is limited access to one side of the wall, provide one side angle installation in strict accordance with UL requirements and damper installation instructions.
- C. The following is a description of the fire damper types as indicated on the plans:
 - 1. TYPE "A"
 - a. Low velocity (below 2000 fpm) with blades stored in the air stream.
 - 2. TYPE "B"
 - a. Low velocity with blades stored out of the air stream.
 - 3. TYPE "C"
 - a. High velocity with blades stored out of the air stream and rectangular, round, or oval duct collar each side.

2.3 PRESSURE DIFFERENTIAL GAUGES

- A. Pressure differential gauges for air filter application shall be direct reading diaphragm type with die cast aluminum housing, acrylic cover, hi/lo air taps on back and side, 4" white dial with red tipped indicator. Gauge shall be accurate to 2% over the full scale at 70 deg. F. Gauge shall include graduated marking scale in "inches of water". Range shall be appropriate for the application to read approximately mid scale for the anticipated pressure reading. Each gauge shall be furnished with vent valves, aluminum or plastic tubing, static pressure tips and mounting bracket or flange.

2.4 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIR, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- C. Vane Construction: Single and Double wall.
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.5 DUCT-MOUNTED ACCESS DOORS

- A. Access doors shall be factory fabricated constructed of the same material as the ductwork (except galvanized sheet metal for fiberglass duct), complete with hinged door, cam lock latches, frame and neoprene gasket between door and frame. Doors in insulated ductwork (internal and or external) shall have double wall insulated doors. Access doors shall be 18" x 16" minimum except smaller where duct size will not permit such size.
- B. Access doors and panels shall be designed to provide tight seal commensurate with the duct pressure. Apply duct sealer or rubber gasket between frame and duct and on ducts of 3" S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.
- C. Where sufficient clearance is not available to allow the door to swing open 90 degrees, an access panel with neoprene gasket, frame and cam lock latches on all four sides shall be provided in lieu of the hinged door.
- D. Plenum access doors shall be factory fabricated and as described for duct access doors except that doors shall be 18" x 48" (unless otherwise noted) with overlapping frame, continuous piano hinge and heavy duty latches (with lever of both outside and inside) equal to Ventfabrics "Ventlok No. 31." Two latches shall be provided except on doors 50" and higher three shall be provided. Frame shall be mechanically fastened to the plenum wall.
- E. Access doors in kitchen exhaust ducts shall be rated specifically for the application and installed in accordance with code clearances from the top and the bottom of the duct.

2.6 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. Ventfabrics, Inc.
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 30 oz./sq. yd.
 2. Net Fabric Width: 4" wide.
 3. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 4. Service Temperature: Minus 40 to plus 200 deg F.

2.7 FLEXIBLE DUCTS

- A. Flexible insulated duct shall be constructed of galvanized steel spiral wire mechanically locked to an airtight aluminum or polyester inner core, 1" thick 3/4 lb. density fibrous glass insulation and a polyethylene or reinforced metalized vapor barrier outer jacket equal to Flexmaster Type 5 or 5M. Duct shall be rated at a minimum of 6" positive and 4" negative static pressure and shall be listed as Class 1 Air Duct or Air Duct Connector with 25-50 flame-smoke ratings per UL 181 and comply with NFPA 90A.
- B. Non-insulated flexible duct equal to Flexmaster NI-85 may be used on duct systems not specified to be insulated, with similar restriction stated above.
- C. Flexible duct shall be used at final connections to air control terminal units and ceiling air diffusers except as limited in Part 3.

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.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts.
- C. Fire dampers shall be installed in conformance with manufacturer's instructions and SMACNA recommendations. Dampers shall be installed in sheet metal wall or floor sleeves along with retaining angles and duct access doors or panels. Sleeve and duct connections shall be breakaway type or rigid type with corresponding gauge requirements in accordance with SMACNA recommendations.

- 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 or stainless steel volume dampers in dishwasher exhaust duct; do not provide dampers in kitchen hood exhaust duct.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install air filter pressure differential gauges in a readable location on each air handling unit filter housing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. At outdoor-air intakes and vent air plenums.
 - 2. Downstream from manual volume dampers, control dampers and equipment.
 - 3. Adjacent to and close enough to fire 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.
 - 4. Control devices requiring inspection.
 - 5. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Label access doors according to Division 23 Section "Identification for HVAC System" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment.
- K. Connect flexible ducts to metal ducts with Panduit straps or stainless steel clamps. End of the insulation and jacket shall be sealed to the metal duct with double wrapped duct tape. Maximum length of flexible duct shall be:
 - 1. Supply ducts to terminal units – 3 ft.
 - 2. Air devices to ducts – 4 ft
- L. Flexible duct shall not be installed:
 - 1. Where ductwork is exposed.
 - 2. Thru any wall, ceiling, floor or fire rated assembly.
 - 3. Above any inaccessible ceiling.

END OF SECTION 23 3300

SECTION 23 3400 - FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Tubular Centrifugal.
 - 2. In-Line Centrifugal.
- B. Related Sections
 - 1. 23 0513 Electrical Requirements for HVAC Equipment
 - 2. 23 0548 Vibration Control

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Fans shall be constructed, rated and labeled in accordance with AMCA Standard 210-67. Fans shall be statically and dynamically balanced throughout the operating range.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fans shall be provided as specified below and shown on the drawings, complete with motors, drives and associated devices.

- B. All fans of any one listed type shall be of the same manufacturer.
- C. Motor HP shall be sufficient to handle the full load of the fan, including drive losses, at the selected condition without exceeding the motor rating. In no case shall the motor size be less than shown without prior approval from the Engineer. All motors 1 HP and larger shall be “premium efficiency” series.
- D. Motors which are fed from variable frequency drive controllers for variable speed operation shall be designed and constructed for VFD drive duty and shall be compatible with the controller specified in Section 23 0531 Equipment Drives. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
- E. Motorized backdraft dampers, where specified, shall be furnished with a motor with voltage compatible with the fan motor voltage and electric service to the fan. If not compatible, a transformer shall be furnished with the fan and damper to afford the appropriate voltage.

2.2 TUBULAR CENTRIFUGAL

- A. Tubular centrifugal fan shall consist of a backwardly inclined double wall airfoil bladed fan wheel (24” diameter and smaller may be flat bladed), motor with adjustable base, “V” belt drive (two belts minimum) with adjustable or fixed drive pulley as noted and belt guard.
- B. Steel tubular housing with inlet and outlet duct flanges, inlet cone, straightening vanes and gasketed access panel in the housing.
- C. Fan bearings shall be grease lubricated pillow block ball bearings, 400,000 hour L50 average rated life, with extended lubricating fittings and tubing,
- D. Fan inlet vanes, with roller or sleeve shaft bearings, shall be arranged with linkage of automatic operation.
- E. Vibration isolators shall be open steel spring isolators with 1.5” static deflection / furnished as indicated on the drawings.
- F. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Greenheck
 - 2. New York Blower
 - 3. Twin City

2.3 IN-LINE CENTRIFUGAL

- A. In-line centrifugal fan shall consist of a backwardly inclined fan wheel, motor, adjustable “V” belt drive (except fans with 13” diameter or smaller wheel may be direct drive), belt guard, motor disconnecting means and inlet cone.
- B. Housing shall be square sheet metal with 1” acoustical lining, galvanized or prime coated and finished with enamel paint.

- C. Housing shall be provided with mounting brackets with neoprene vibration isolators for suspension mounting.
- D. Direct drive units shall have motor out of the air stream and be furnished with a solid state speed controller with off position, and cover plate. The speed controller shall be turned over to the Electrical Contractor for installation.
- E. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Greenheck
 - 2. Cook
 - 3. Acme

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans and roof curbs level and plumb, in accordance with manufacturer's written instructions.
- B. Support units as described below using the vibration control devices specified herein and in Section 23 0548 Vibration Control.
 - 1. Roof curb mounted units: Set unit on the curb and fasten the fan base to the curb.
- C. Arrange installation of fans to provide access space around fans for service and maintenance.
- D. Adjust damper linkages for proper damper operation. Motorized backdraft dampers are to be wired to open when the fan operates.
- E. Perform the following operations and checks before start-up.
 - 1. Remove shipping blocking and bracing.
 - 2. Verify unit is secure on mountings and supporting devices and that connections for ductwork and electrical are complete. Verify proper thermal overload protection is installed in motors starters and disconnects.
 - 3. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Align belts and reinstall belt guards.
 - 4. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
 - 5. Verify manual and automatic volume control, and fire dampers in connected ductwork systems are in the full open position.

END OF SECTION 23 3400

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SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grilles
2. Registers
3. Diffuser

B. Louvers are to be furnished by the HVAC subcontractor and installed by the General Contractor. Refer to drawings for specific louver requirements.

C. Related Sections:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

A. Air outlet and inlet devices shall be equal to those specified by catalog number and description in the schedule on the drawings. Damper operators shall be concealed screw type. An auxiliary mounting frame shall be furnished with each grille and register where scheduled.

B. Manufacturers:

1. Price
2. Titus
3. Tuttle & Bailey

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall be responsible for compatibility of ceiling mounted devices with the ceilings and suspension systems (lay-in, concealed spline, plaster, drywall, etc.). Verify with architectural drawings.
- B. Carefully align square and rectangular devices with the vertical and horizontal building lines. Diffusers shall be attached rigidly to the ductwork. Take particular caution to firmly secure registers or grilles in exposed ductwork areas. Where connected by flexible ducts, special supports shall be provided as required, either from the ceiling suspension system or by independent suspension wires or rods from the building structure.
- C. Inside of ducts behind grilles, registers, and diffusers shall be painted flat black, as needed, to eliminate the sight of shiny surfaces.

END OF SECTION 23 3713

SECTION 23 5100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Listed double-wall vents and chimneys.
 - 2. Furnace and Domestic Water Heater Single Wall sidewall vents

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Building-heating-appliance chimneys.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 UNIT HEATER AND RADIANT UNIT HEATER

- A. Flues for furnaces unit heater UH-1 and radiant heaters RH-1, RH-2, RH-3 and RH-4.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Metalbestos.
 - 4. Van-Packer Model
- C. Description: Double-wall metal vents tested according to UL 103 and rated for 1000°F continuously, or 1700°F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
- D. Construction: Inner shell and outer jacket separated by at least a 1-inch air space.
- E. Inner Shell: AL 29-4C Stainless steel.
- F. Outer Jacket: 304 Stainless steel.

- G. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

- 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

2.2 FURNACES AND DOMESTIC WATER HEATER

- A. Flues and intake for furnaces FRN-1, FRN-2, FRN-3, FRN-4 and FRN-5, and domestic hot water heater DWH1.
- B. Manufacturers: Subject to compliance with requirements, provide products by Ipex System 636 CPVC or equal
- C. Description: Schedule 40 CPVC vents tested and listed to ULC S636 rated for up to 194 deg F, rated for negative, neutral or positive venting systems.
- D. Accessories: Tees, elbows, increasers, terminations, concentric vent kits, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

PART 3 - EXECUTION

3.1 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- C. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- D. Lap joints in direction of flow.
- E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- F. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- G. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 5100

SECTION 23 5523 - GAS-FIRED RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gas-fired, tubular infrared radiant heaters.

1.2 SUBMITTALS

- A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Detroit Radiant – Re-Verber-Ray
 2. Superior Radiant Products (SRP)
 3. Gas-Fired Products Inc.; Space-Ray Div.
 4. Reznor/Thomas & Betts Corporation.
 5. Roberts-Gordon, Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.
- C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- D. Combustion Tubing: 4-inch- 16 gauge aluminized coated steel radiant emitter tubes.
- E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.
- F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree tilt from vertical.
1. Include hanger kit.
- G. Burner Safety Controls:
1. Gas Control Valve: Modulating, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
 3. Control Panel Interlock: Stops burner if panel is open.
 4. Indicator Lights: Burner-on indicator light.
- H. Burner and Emitter Type: Gravity-vented power burner, with the following features:
1. Emitter Tube: 4-inch- diameter, aluminized-steel tubing with sight glass for burner and pilot flame observation.
 2. Venting: Connector at exit end of emitter tubing for vent-pipe connection.
 - a. Vent Terminal: Vertical.
 3. Burner/Ignition: Power gas burner with electronic spark and electronic flame safety.
 4. Burner/Ignition: Stainless-steel burner cup and head with balanced-rotor draft fan and hot-surface ignition.
 5. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan.

2.2 CONTROLS

- A. Thermostat: Devices and wiring are specified in Division 23 Section "Instrumentation and Control for HVAC."

- B. Thermostat: Wall-mounting type with 50 to 90 deg F operating range and fan on switch.
 - 1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' recommended clearances to combustibles.
- D. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.
- E. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, and Stacks."
- F. Electrical Connections: Comply with applicable requirements in Division 26 Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- G. Adjust initial temperature set points.
- H. Adjust burner and other unit components for optimum heating performance and efficiency.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 5523

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DIVISION 26 ELECTRICAL

26 0000 General Requirements for Electrical Systems

- 26 0001 Basic Electrical Requirements
- 26 0004 Firestopping for Electrical Systems
- 26 0005 Excavation, Backfill and Surface Restoration

26 0500 Common Work Results for Electrical

- 26 0519 Low-Voltage Electrical Power Conductors and Cables
- 26 0523 Control-Voltage Electrical Power Cables
- 26 0526 Grounding and Bonding for Electrical Systems
- 26 0529 Hangers and Supports for Electrical Systems
- 26 0533 Raceway and Boxes for Electrical Systems
- 26 0543 Underground Ducts and Raceways for Electrical Systems
- 26 0553 Identification for Electrical Systems
- 26 0563 Specific Wiring Applications

26 0900 Instrumentation and Control for Electrical

- 26 0923 Lighting Control Devices
- 26 0943 Network Lighting Controls

26 2000 Low-Voltage Electrical Distribution

- 26 2416 Panelboards
- 26 2726 Wiring Devices
- 26 2813 Fuses
- 26 2816 Enclosed Switches and Circuit Breakers
- 26 2913 Enclosed Motor Controllers

26 3000 Facility Electrical Power Generating and Storing Equipment

- 26 3214 Engine Generators (Natural Gas)
- 26 3623 Automatic Transfer Switches

26 4000 Electrical Cathodic Protection

- 26 4313 Surge Protective Devices (SPD) for Low-Voltage Electrical Power Circuits

26 5000 Lighting

- 26 5113 Interior Lighting Fixtures, Lamps and Drivers
- 26 5200 Exit and Emergency Lighting
- 26 5600 Exterior Area Lighting

26 6000 Electronic Safety and Security

26 6101 Fire Detection and Alarm System

26 7000 Miscellaneous Equipment & Communications

26 7000 Suspended Ceiling Mounted Circulation Fans

26 7510 Data Equipment Room Fittings

26 7533 Raceway and Boxes for Communications Systems

26 7561 Voice and Data Communications Horizontal Cabling

SECTION 26 0001 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements
2. Definitions
3. Scope of Work
4. Drawings and Specifications
5. Reference Standards
6. Allowances, Unit Prices and Alternates
7. Site Visit
8. Permits, Regulations and Inspections
9. Project Management and Coordination
10. Temporary Electric Services
11. Workmanship
12. Protection
13. Painting
14. Cleaning
15. Equipment Selection
16. Shop Drawings
17. Testing
18. Final Inspection and Punch List
19. Operation and Maintenance Manuals
20. Record Drawings
21. Warranties
22. Operation and Adjustment of Equipment
23. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Electrical work.
- C. A complete and functional Electrical system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SCOPE OF WORK

- A. The scope of the electrical work includes furnishing, installing, testing and warranty of all electrical work and complete electrical systems shown on the electrical drawings and specified herein, including Division 00, Division 01, Division 26 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having equipment, wireways and fittings

fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install wireways, fittings and equipment.

- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment – 600 Volts Nominal or Less. For Equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance and Access to Work Space – 110.34 Work Space and Grounding. The Electrical Contractor shall caution other trades to comply with this stipulation.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the Contractor causing such conflict. The Architect's decision shall be final in regard to arrangement of equipment, conduit(s), devices, wireways etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Each contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved from the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Section 017300 Execution.

- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the Electrical contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the Electrical work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities except fire alarm permit documents shall be prepared and submitted by an approved, licensed fire alarm subcontractor.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for ¼" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.11 TEMPORARY ELECTRIC SERVICES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. The temporary service and temporary lighting for construction is provided by the Electrical Contractor.
- C. The Electrical Contractor is cautioned to carefully consider the possible sources of temporary electric service and the probable location of the General Contractor's office.

- D. The General Contractor will make application to the local utility company for the temporary electric service and will pay for all electric power used during construction, including electric heating.
 - E. The Electric Contractor shall furnish, install and pay for all necessary conduit, wire, metering, poles, switches, receptacles, lights and accessories to provide a 400 amp, 120/230 volt, 3 phase, 4 wire temporary electric service with the main disconnect switch, meter, and a 42 circuit load center at a location specified by the General Contractor.
 - F. Consult the utility company for fees required and include same in Electrical Contract.
 - G. Labor, receptacles, boxes, fixtures, wire, etc. required by the various Contractors inside their offices shall be paid for by the respective Contractors.
 - H. Lighting fixtures shall be placed every 40 ft. along each corridor or where corridors do not occur, along the long axis of all rooms. Provide a minimum 800 lumen lamp in a commercial grade molded plastic socket and lattice wire guard temporary lighting assembly with extra heavy duty "ST" 3-wire cord. Lamps shall be spaced a minimum of 10 ft. apart. For large open areas or during the early stages of construction, 250 watt metal halide fixtures (or LED equivalent) with wire guards may be utilized. Receptacle circuits shall consist of 1-gang cast "FS" type box with grounded duplex receptacles a maximum of 50 ft. on center with a maximum of 4 per circuit. All receptacle circuits shall be protected by its own overcurrent device in a panel board. Install wiring and equipment above 6'-6" and below the finished ceiling. Extend circuits as required. Provide GFCI protected receptacles and circuits as required by NEC and OSHA.
 - I. Contractors requiring extension cords shall provide their own cords and plugs up to capacity of 20 amperes. For services to larger items of equipment and welders, this Contractor shall extend proper feeders as requested at the expense of the Contractors requiring the service.
 - J. The Electrical Contractor shall maintain the temporary light and power system for the duration of the work and shall remove it from the site when directed. Temporary wiring and equipment shall remain the property of the Electrical Contractor.
 - K. The use of the permanent electrical system for temporary services during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period.
 - L. Warranty periods on equipment, materials and systems shall commence upon Owner acceptance of the building or systems. Temporary use shall not jeopardize or alter warranty requirements.
 - M. The complete temporary service shall comply with Power Company, OSHA, and all Code requirements.
- 1.12 WORKMANSHIP
- A. Refer to Section 01400 Quality Requirements.
 - B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all

respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.

- C. Electrical work shall be performed by a licensed Electrical Contractor in accordance with requirements of the jurisdiction.

1.13 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.14 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in the Electrical Contract:
 - 1. All metal which is not factory or shop painted and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms and other unfinished areas shall be given a prime coat of paint.
 - 2. All metal installed outside the building which is not factory or shop painted shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
 - 4. Apply Z.R.C. Cold Galvanizing Compound, or approved equal, for touch-up of previously galvanized surfaces.

5. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.

- B. Finish painting is included in the General Contract. Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

1.15 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.
- D. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be in accordance with equipment manufacturer's recommendations.
- E. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

1.16 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL label items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
 2. Where the words "or approved equal" appear after a manufacturer's name, specific written approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval during shop drawing submittal.

- D. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- E. Before bidding equipment, and again in the preparation of shop drawings, the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment and that required NEC (and other applicable Code's) clearances are met. The Contractor and his supplier shall also verify compatibility of equipment specified with available system/service voltages, etc.
- F. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment or existing site conditions which are not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.17 SHOP DRAWINGS

- A. Refer to Section 016000 Product Requirements.
- B. One set of shop drawings, in electronic format (pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Electrical Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings of the following electrical equipment and materials shall be submitted:
 - 1. Firestopping.
 - 2. Wireway.
 - 3. Miscellaneous cabinets.
 - 4. Plenum cable.
 - 5. Wiring devices and coverplates.
 - 6. Service/Distribution switchboard.
 - 7. Panelboards and associated distribution equipment.
 - 8. Fuses.
 - 9. Motor controllers (VFD's) and disconnects.
 - 10. Lighting Controls including layout plans of Occupancy Sensors.
 - 11. Low voltage switching/lighting control system
 - 12. Lighting fixtures and lamps.
 - 13. Lighting standards.

14. Fire alarm system with schematic and point to point wiring diagrams.

1.18 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Architect or Engineer.
- D. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder when appropriate. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests.
- E. Instruments required for tests shall be furnished by the Contractor.

1.19 FINAL INSPECTION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.
- B. As the time of work completion approached, the Contractor shall survey and inspect his work and develop his own punch list to confirm it is complete and finished. He shall then notify the Architect and request that a final inspection be made. It shall not be considered the Architect's or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.
- C. Requests to the Architect, Engineer or Owner for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- D. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.20 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. Two copies each of operating and maintenance manuals shall be assembled for the Electrical work by the Contractor.
- C. All shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the

type of replacement material required. Major items of equipment shall consist of not less than the following:

1. Distribution switchgear.
2. Motor controllers.
3. Fire Alarm System.
4. Specialty equipment.

- D. Standard NEMA publications on the operation and care of equipment may be furnished in lieu of manufacturer's data where the manufacturer's instruction is not available.
- E. These shall be assembled into three-ring loose leaf binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.21 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. The Electrical Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.22 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one (1) year minimum from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems and placed in operation. These items include, but are not limited to, motor controller malfunction, heater element changes required for motor controller, fuse replacement where fuses blow due to abnormal shorts, adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.
- D. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

- F. Extended warranties shall be provided where indicated in the equipment specification Sections.

1.23 OPERATION AND ADJUSTMENT OF EQUIPMENT

- A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents and adjusting all operating equipment.
- B. Caution: Verify that all bearings of equipment furnished are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the other trades judgment in these matters. Follow specific instructions in regard to lubrication of equipment furnished under this Contract.

1.24 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 26 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 8 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 26 0001

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SECTION 26 0004 – FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 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: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every conduit or opening at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for conduit on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.
- F. Refer to 26 0533 Raceway and Boxes for Electrical Systems for sleeve requirements and treatment of penetrations not requiring firestopping.

END OF SECTION 26 0004

SECTION 26 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over conduit or duct in a trench, including haunches to support sides of conduit.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated sub-grade in a trench before laying manhole, pullbox or conduit.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 26 002 Basic Electrical Materials and Methods. All work shall comply with requirements set forth in Division 2.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

- 2.1 Refer to Division 31 Earthwork for bedding and backfill materials

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Interior and exterior trenches shall be over-excavated and the conduits, ducts or conductors shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or crushed limestone,

3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the conduit or conductor. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.

- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- F. All exterior underground direct buried conductor, conduit and concrete encased ducts shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6" wide with black letters identifying the type of service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the conductor, conduit or duct.
- G. In addition to a warning tape, concrete encased ducts shall have a concentrated red dye poured on top of the concrete before fully cured.

END OF SECTION 26 0005

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SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.
- C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC and metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- 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. AFC Cable Systems, Inc.
 2. Hubbell Power Systems, Inc.
 3. O-Z/Gedney; EGS Electrical Group LLC.
 4. 3M; Electrical Products Division.
 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded, Aluminum may be utilized where specifically noted on drawings.
- B. Branch Circuits: Copper. Stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Existing Walls and Fixture Whips: Armored Cable, Type AC, Metal-Clad Cable, Type MC, cable shall have separate internal ground wire.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Power-limited cable, in raceway.
- H. Use type THHN or XHHW (90 degrees C. rated) for connecting fluorescent fixtures and for running thru fixture housings.
- I. Use conductors such as type FEP with high temperature insulation as identified in the NEC for connections to resistance heating elements or in other areas subject to temperature exceeding the rating of THWN, XHHW or THHN.
- J. In addition to the conduit system, a separate grounding conductor shall be installed with all feeders and branch circuitry.

- K. Equipment grounding conductors shall be green, or completely taped green, at all accessible points.
- L. Wire size ampacity shall equal or exceed its overload protective device. Where sizes shown on the drawings are greater than the apparent ampacity requirements, the size shown shall prevail to compensate for voltage drop. In no instance shall conductors be installed that are less than required by the N.E.C. Minimum conductor size shall be No. 12 AWG except No. 14 AWG may be used for control wiring or where otherwise specifically indicated.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Provide a separate neutral for each branch circuit serving receptacles (no shared neutral).
- 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. Conduit systems shall be clean and clear before pulling wires. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Pulling of branch circuit conductors shall be performed by manual means without the use of levers or heavy pulling devices that may compromise the conductor's or insulation integrity.
- E. A maximum of 8 conductors shall be installed in a branch circuit conduit unless specifically noted otherwise on the drawings. Equipment ground conductors are not counted when determining maximum fill.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Wiring in vertical raceways shall be supported with strain relief devices; Kellems grips or approved equal.
- H. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- I. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- L. Underground splices (including splices in exterior pullboxes and manholes) shall be made using sealing kits or wire nuts U.L. listed and approved for the application.

- M. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack. Refer to additional notes on plans for branch circuitry installation requirements.

3.4 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. On all electric services including change-outs, backfeeds, etc. the Contractor shall verify phase rotation and voltage readings to assure the final installation is proper. Submit to the Engineer in writing a record of voltage readings and current readings taken at no-load and fully loaded conditions.
- D. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Engineer.
- E. Tests shall be witnessed by field representatives of the Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.
- F. Instruments required for tests shall be furnished by the Contractor.

END OF SECTION 26 0519

SECTION 26 0523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Low-voltage control cabling.
 - 2. Control-circuit conductors.
 - 3. Identification products.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- B. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.
- C. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: **25** or less.
 - 2. Smoke-Developed Index: **50** or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." **Flexible metal conduit shall not be used.**
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 4 inches high, and 2-1/2 inches deep.

2.2 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.3 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.4 IDENTIFICATION PRODUCTS

- 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. Brady Corporation.
 - 2. HellermannTyton.
 - 3. Kroy LLC.
 - 4. Panduit Corp.

- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows if possible.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Installation of Control-Circuit Conductors:
 - 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than **60 inches** apart.
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

3.3 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No 14 AWG.
 - 2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.4 FIRESTOPPING

- A. Comply with requirements in Section 26 0004 "Firestopping for Electrical Systems."

3.5 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

- A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 0523

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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.

2.2 GROUNDING RODS

- A. Grounding Rods shall be copper clad, molten welded copper to steel; unless otherwise designated, 3/4" diameter X 10 ft. long.

2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory 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, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be made with welded connections (“Thermoweld” or “Cadweld”).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. 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. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels.
- B. 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.

- C. Wiring devices shall be connected with grounding jumper from ground pole on device to grounding screw (or grounding pigtail) in the outlet box.
- D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to central equipment location.
 - 1. Service and Central Equipment Location: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 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. 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 so vibration is not transmitted to rigidly mounted equipment.
- C. Main service neutral shall be grounded to the street side of the building water service. A bonding jumper shall be installed around the water meter. In addition to using the water service as a grounding electrode, effectively grounded building steel, driven ground rods outside or buried electrode shall be provided and connected. Bond to interior metallic water, gas and all other metallic lines.
- D. The complete metal conduit system shall be used for the equipment grounding system. Conduit systems and associated fittings and terminations shall be made mechanically tight to provide a continuous electrical path to ground and shall be safely grounded at all equipment by bonding all metallic conduit to the equipment enclosures with locknuts cutting thru paint of enclosures. Bond all conduits entering service entrance switchboard with a ground wire connecting the grounding bushings to the equipment ground bar. Conductors shall be sized per NEC Tables 250-66 and 250-122. Bond all communications conduit systems to ground.
- E. In addition to using the conduit system for grounding, a complete auxiliary green wire equipment grounding system shall be installed, continuous from main ground, thru distribution and branch circuit panelboards and paralleling all feeders and branch circuit wiring. Grounding conductor sizes shall comply with NEC Table 250-122, minimum size shall be #12 copper except #14 on control circuits. This shall apply to all circuits rated 100 volts or more above ground potential.

- F. Motor frames shall be bonded to the equipment grounding system by an independent green wire, sized as shown.
- G. Cord connected appliance frames shall be grounded to the equipment grounding system thru a green wire in the cord.
- H. A green grounding conductor shall be installed in each non-metallic conduit and all flexible conduits, including exterior underground conduits.
- I. System neutral connections shall be insulated from metal enclosures except at the neutral of the service entrance equipment and on the neutral of a separately derived system. Connections to the main service enclosure shall be by means of bonding jumpers.
- J. The building neutral shall be identified throughout with white conductors for 240/120 volt systems.
- K. A minimum #6 ground wire shall be run from ground bar in I.T. Room back to the main building ground. Or where indicated on the drawings or in the specifications, a separate communications grounding system shall be provided and bonded to the electrical grounding system at the main ground bar.
- L. Bond the generator neutral to the generator equipment grounding conductor. Bond the generator frame to the equipment grounding conductor. Provide signs at the grounding locations per NEC Article 701.
- M. Where metal covers on pull boxes and junction boxes are used, they shall comply with the grounding and bonding requirements of NEC Article 250.
- N. Connections to driven ground rods or other such electrodes shall be a minimum of 3 feet from the building foundation wall or beyond the roof drip line, whichever is greater.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 - f. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. 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) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Utilize supports with swivel type attachments to maintain true vertical support from sloped structure or inclined structural elements (such as beam clamp with swivel option).

- 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.
- 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. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on blocking attached to substrate by means that meet anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 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, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel only; set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Brushed Aluminum with snap-on covers.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Mono Systems.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Hubbell Wiring Systems.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets:
 - 1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, 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: Rigid steel conduit. Includes raceways in the following locations:
 - a. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT except FMC may be utilized in existing walls.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Damp or Wet Locations: Rigid steel conduit.
 - 7. Raceways for Optical Fiber or Communications Cable: EMT.
 - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. EMT: Use all steel, compression type or all steel setscrew type, concrete tight.
 - 3. Flexible conduit: Use malleable iron, "squeeze" type, non-insulated. (For lighting fixture whips only: Use all steel or die-cast screw-in connector).
 - 4. Liquid-tight conduit: steel or malleable iron.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Generally run conduit and conductors as high as practicable against underside of floor slab in concrete construction or immediately below the **top chord** of bar joist construction unless otherwise shown or noted. This high level zone shall be used for running electrical raceways and shall be grouped or racked together wherever feasible. Runs at bottom chord level or ceiling grid level are not acceptable.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation. Plan raceway routing to minimize the number of offsets and junction boxes.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. All conduit shall parallel building lines.
- G. Conduit shall be run overhead and shall not be run below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.
- H. Conduit crossing building expansion joints shall have expansion provisions with grounding continuity, use special expansion fittings listed for the application. Refer to the Architectural and Structural floor plans and details for locations of expansion joints.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. 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.
- K. Raceways for Data, Audio Visual and Communications Cable: Install as follows:
 - 1. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
 - 3. Raceway shall be installed continuously from outlet box to above edge of nearest cable tray above accessible ceiling.
 - 4. Bond raceway to cable tray with approved grounding bushing, bonding jumper and necessary fittings.
- L. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in all locations except MC may be used for lighting fixture whips.
- M. 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.
- N. Do not install wall-mounted boxes back-to-back in opposite sides of wall; in stud walls, boxes shall be on opposite side of studs.

- O. Provide access to all junction and pull boxes.
- P. Set metal floor boxes level and flush with finished floor surface. Provide trim ring compatible with finish floor system.
- Q. Pull mandrel or large swab thru conduit to assure freedom from debris before pulling wires. Use listed pulling lubricants where necessary.
- R. Provide four (4) 1 inch diameter spare conduits for each flush mounted branch circuit panelboard; extend from top of panelboard to above an accessible ceiling for future use.
- S. Contractor shall record carefully on a set of "as-built" prints, the exact location of all feeder conduits (100 amps and larger).
- T. Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only.

END OF SECTION 26 0533

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SECTION 26 0543 –UNDERGROUND DUCTS AND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.

1.2 SUBMITTALS

A. Product Data: For accessories for handholes, and boxes.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.
4. Ladder/Step details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

D. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. Utilize galvanized rigid steel for 90 degree bends (long sweep type) with proper adapters between PVC duct and galvanized steel.

2.2 NONMETALLIC DUCTS AND DUCT 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. Cantex, Inc.
 - 2. CertainTeed Corp.; Pipe & Plastics Group.
 - 3. Heritage Plastics.
 - 4. Carlon Electrical Products.
 - 5. Manhattan/CDT; a division of Cable Design Technologies.
 - 6. Spiraduct/AFC Cable Systems, Inc.
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, to provide minimum duct spacings while supporting ducts during concreting or backfilling.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Green.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, As indicated for each service.
 - 6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer Handholes and Boxes: Molded of fiberglass-reinforced polymer concrete, with matching covers.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carson Industries LLC.
 - b. Quazite (Hubbell).
 - c. Highline Products, Inc.

PART 3 - EXECUTION

3.1 EARTHWORK AND RESTORATION

- A. Refer to Division 26 Section "Excavation, Backfill and Surface Restoration".

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends at other locations, unless otherwise indicated.
- C. Joints: Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.
- E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- G. Concrete-Encased Ducts: Support ducts on duct separators.
 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
4. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
5. Identify Ductbank with one of the following methods:
 - a. Mark the top of all underground duct runs with concentrated red dye or powder on top.
 - b. Provide 6" wide yellow plastic tape, with black letters indicating "Electric"; place approximately 18" above and continuously along the centerline of duct bank.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set covers of handholes 1 inch above finished grade and boxes with bottom below the frost line.
- D. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 CLEANING

- A. Pull mandrel through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 26 0543

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Wiring device circuit identification.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WIRING DEVICE CIRCUIT IDENTIFICATION

- A. Marker Tape: Self-laminating, clear polyester, 3/8" high tape with black lettering.
- B. Provide label on every wiring device cover plate, indicating panel and circuit breaker fed from. Utilize 12 pt. font. Mount label on face of receptacle cover plate below bottom outlet, mount label on back side of light switch cover plate so that label is not visible.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Phenolic Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Electrical and Auxiliary Systems Box, Conductor and Cable Identification: Use marker tape to identify field-installed branch circuit, alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 - 2. Identify panel and branch circuit number(s) on all junction box covers permanently clearly printed with bold black indelible marker.
 - 3. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. The entire facility is supported by the Life-Safety/Optional Standby Generator, equipment on the Life-Safety systems shall be identified with nameplates having a red background. Receptacles, outlets and switches on the emergency systems shall be identified red. Utilize red devices.
- C. Conduit and junction boxes:

1. Color code or label all junction boxes and exposed conduit at 20 ft. intervals. Coding shall be painted or labels of the pre-manufactured type permanently mounted with metal or plastic band.
 2. Label panelboard and branch circuit number(s) on outside of junction box cover at all junction boxes containing branch circuit wiring. Labelling shall be neatly done utilizing black indelible ink markers.
 3. Paint all junction boxes and covers for fire alarm wiring red.
 4. Provide a color identification scheme under heavy plastic cover hanging in the electrical rooms; identification shall be:
 - a) Life-Safety - Orange
 - b) Normal/Standby - Black
- D. Branch circuit panelboards:
1. Identify panel designation on directory card within the panel.
 2. Fill out branch circuit directory indicating circuit number and area served, rooms, group of rooms, lighting, convenience outlets, motors, etc. Card index shall be neatly typed.
 3. Replace branch circuit directory in existing panelboards in areas of alteration.
 4. Branch circuit phase conductor color format shall be permanently identified inside each panelboard.
- E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated phenolic label. Unless otherwise indicated, provide a single line of text with 1/4-inch- high letters on 5/8-inch- high label; where 2 lines of text are required, use labels 1 inch high.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.

- b. Electrical switchgear and switchboards.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.
 - e. Motor starters.
 - f. Lighting Relay Panel(s).
- 3. Label shall include equipment name, voltage and where fed from. Where equipment is located in finished spaces, accessible to the public, in addition to adhesive, secure labels with screws, one on each end.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 240/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Neutral: White

END OF SECTION 26 0553

SECTION 26 0563 – SPECIFIC WIRING APPLICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Various items of equipment require additional electrical connections, wiring and/or interlocks that are not specifically identified on the drawings or in the specifications. Included, but not limited to, are the following items:
 - 1. Kitchen and laundry equipment.
 - 2. Mechanical/HVAC Equipment and motors.
 - 3. Plumbing Equipment
 - 4. Exterior Lighting Control Equipment.
 - 5. Motorized Doors.
 - 6. Security/Access Control Equipment.
 - 7. Fire Protection/Suppression Equipment.

1.2 COORDINATION

- A. Coordinate wiring requirements and interlocks for equipment provided by other Contractors. Obtain copies of approved Shop Drawings and/or manufacturer's wiring diagrams to determine exact wiring requirements.
- B. This Contractor shall inquire of the Engineer during bidding, or at the earliest practical date, any questions which may arise regarding the intention and scope of this work.

PART 2 - PRODUCTS

- 2.1 Materials and equipment shall be as indicated on the drawings and in the specifications.

PART 3 - EXECUTION

- 3.1 Final connections to fixture pigtails shall be made with approved pressure connectors such as IDEAL “Twister” or T&B “Freespring Winged”.
- 3.2 Miscellaneous Equipment Connections
 - A. Various items of equipment such as kitchen, laundry, HVAC, Plumbing, etc. will be furnished and set in place by other trades. This equipment, unless otherwise shown on the drawings, will be furnished with necessary electrical outlets, operating and control switches, terminating in an electrical outlet box, or equivalent electrical connector located on the equipment. This

contractor shall furnish power wiring to these various items of equipment and connect them up complete for full operation.

- B. Where disconnect switches are indicated or where otherwise required, they shall be mounted in an accessible location. In the case of labs, kitchens, laundries and finished areas, provide NEMA 4X Stainless Steel enclosure and locate in as inconspicuous a place as possible. Locate disconnect switches under counters where feasible and accessible in lieu of above counter, however, this contractor shall ensure that the installation of equipment does not interfere with access and operation of such switches.
- C. Where necessary to expose conduit in finished spaces, rigid aluminum conduit and conduit body ("LB") fittings shall be utilized.
- D. Coordinate and provide any additional 120 volt power connections required for special low voltage systems devices or equipment panels such as Security System/Door Access System control panels, door strikes, surveillance cameras, security/fire shutters or doors, temperature control system panels/transformers, etc.
- E. Roughing-in drawings for equipment shall be obtained from the Architect or Contractor providing the equipment with substantial time prior to the installation of such equipment to enable proper electrical rough-in equipment.

3.3 Miscellaneous Wiring Interlocks

- A. Various items of work are required in connection with interlocking motor and starter/VFD operations and providing wiring to serve equipment which is furnished by other trades.
- B. Interlocks between motor controllers for purposes of accomplishing sequence control or simultaneous operation of motors are all to be included in the Electrical Contract. Requirements for a simple simultaneous motor operation interlock are indicated by a schedule on the drawings or by specific notes. These interlocks consist of auxiliary contacts on the starter/VFD of the lead motor wired in, according to standard diagrams of the motor starter/VFD manufacturer to energize the holding coil of the starter or VFD control input for the motor. These interlocks shall be thru the "automatic" position only of the starter/VFD where HOA switches are supplied. Furnish extra contacts on external relays as required for interlocks. Where interlocks, other than the simple sequence above, are required, they shall be as described as follows in this section.
- C. Air handling unit motors shall lead and exhaust fans and moving media air filters (if applicable) follow. Hot water pumps shall lead and boilers follow.
- D. The following is a list of equipment and systems requiring wiring. Note that these are in addition to standard interlocks scheduled on the drawings.
 - 1. Exterior lighting shall be controlled via a lighting control relay system as scheduled on the drawings. Refer to specification section 26 0943 for system requirements.
 - 2. Motorized backdraft dampers on exhaust fans and power roof ventilators shall be connected to their respective associated motor leads (or starter control transformer) to energize the backdraft damper motor and open the damper when the fan operates.

Dampers, operator and transformer, if required, will be furnished by the fan supplier, install transformer and wire to damper.

3. Motorized Doors: Door controls, including door switches (pressplates, prox sensors, etc.), limit switches, relays, etc. will be furnished by the door equipment supplier. This equipment shall be turned over to the Electrical Contractor and installed for a complete and operational motorized door operator system per the equipment supplier wiring diagrams. Provide additional boxes, conduit and wiring as required per the supplier's diagrams and to meet field conditions.
4. Boiler re-circulating pump starters shall be equipped with an auxiliary contact to accommodate an interlock between the boiler and the pump. Wiring on this control shall be in the Electrical Contract.
5. Independently mounted controllers furnished by others: Where starters/VFD's are furnished by other trades, and are required to be mounted remote from the motor, the Electrical Contractor shall accept and mount them and perform all power and control wiring between the controls and motors indicated. Motor controllers equipped with automatic alternators shall have two independent circuits and control sources to preclude loss of operation when one circuit fails.
6. Kitchen hood has control switches for remote fan and integral light(s). The E.C. shall provide circuitry to hood switch/ light and fan and provide wiring between fan switch and motor starter/damper.
7. Provide local control switch and wiring to garbage disposer in kitchen.
8. Provide circuit with local disconnect to control transformer(s) for electronic flush valves and water faucets. Coordinate locations and power requirements with P.C.
9. Provide power connection to dry agent fire suppression system in I.T. Room and provide all control/interlock wiring from suppression system to HVAC cooling system for Room to shut system down prior to discharge of suppression system.
10. Provide all alarming system control/interlock wiring (as well as associated relays) from Fire Call System (Mach Alert System) dry contact closures for alarming system lights located throughout the building interior and exterior as shown on the plans.
11. Coordinate power requirements and connection/receptacle locations in I.T. Room for data rack power, Radio System power and various equipment systems (by Owner) located in I.T. Room. Coordinate receptacle locations on walls of Room (and quantities) with the System Vendors to accommodate cord lengths furnished with equipment and provide additional receptacles as necessary.

END OF SECTION 26 0563

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SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Indoor occupancy sensors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy/vacancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY/VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Lighting.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lutron Electronics.
 - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 5. Watt Stopper (The).
 - 6. Sensorswitch.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. 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.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. Dual Technology Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. 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.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.
- D. Emergency Bypass Relays:
1. Where an emergency power system is available and plans indicate control of emergency lighting via occupancy sensor controls, provide U.L. 924 Listed emergency bypass relay(s) to illuminate emergency lighting from emergency power system during a normal power outage.
 2. Where plans indicate dimming control of the room lighting, the bypass relay shall be compatible with the room dimming requirements to enable dimming of designated emergency fixtures but shall bypass dimming control and illuminate the fixture(s) to full brightness upon loss of “normal/standby” power.
- E. Application:
1. Utilize sensor type to best apply to the area it controls (i.e. office, corridor, restrooms, etc.) and provide proper quantity and spacing of sensors to adequately cover the entire area it serves. Carefully coordinate locations of partial height moveable gear storage cabinets/furniture that may inhibit coverage of wall or ceiling mounted sensors. Reposition (or provide additional sensors) as required if control coverage is not adequate after equipment is put in place.
 2. Sensors shall be located and adjusted in private office to prevent incidental activation from passerby in hallways or sensor shall utilize ‘adaptive’ technology to recognize usage patterns and adjust sensitivity.

3. Provide override switch where indicated on plans to disable operation of sensor and leave lights off.

2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "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 Division 26 Section "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 Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Sensors shall be set to default in vacancy mode except for public restrooms or where specifically noted otherwise.
- C. After construction period and just prior to turn-over of facility for beneficial use, reset all sensors that are "Adaptive Technology" (or "Smart Technology") to initiate their "learning mode" while in use by the Owner during move-in and beneficial use. Follow up with necessary sensor adjustments within 15 working days.
- D. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. 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 Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy/vacancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 0923

SECTION 26 0943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manually operated, digital lighting controls with external signal source, relays and programmable control module.
- B. See Division 26 Section "Lighting Control Devices" for occupancy sensors.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- B. Monitoring: Acquisition, processing, communication, and display of equipment status data, event signals and event logs.
- C. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

1.3 SUBMITTALS

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths, and other devices to be used. Describe characteristics of data communication lines.
 - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
- D. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files or obtainable as a file download from the manufacturer.
3. Device address list.

E. Field quality-control test reports.

F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

G. Operation and maintenance data.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components. Match components and interconnections for optimum performance of lighting control functions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Failure of software input/output to execute switching commands.
- b. Failure of modular relays to operate under manual or software commands.
- c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.

3. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.7 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
 - 1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade equipment/software, if necessary.

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. Intelligent Lighting Controls, Inc.
 - 2. Leviton Mfg. Company Inc.
 - 3. Sensorswitch.
 - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 5. Hubbell Lighting Control Systems.
 - 6. Watt Stopper (The).
 - 7. Greengate (Cooper Controls).

2.2 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future as scheduled on the drawings.
- B. Performance Requirements: Manual switch operation, occupancy sensor, photocell sensor or other external input device sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads. Or a programmed time of day sequence or any combination of programmed time of day sequence and/or manual input operation sends an appropriate signal to the control module to control appropriately programmed relays to open or close to control lighting or other loads.

2.3 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Unit shall be programmable for control of

indicated number of output circuits. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices, all located in other enclosures. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable. An integral alphanumeric LCD shall display manual-control and programming steps. Modules and their associated control panels shall include the following features:

1. Multichannel output with number of channels scheduled on the drawings.
2. Multiple inputs for indicated programmable control stations and other sources.

2.4 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 and UL 916; factory assembled with modular single-pole relays, two-pole relays or contactors, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.
 - a. Barriers separate low-voltage and line-voltage components.
 - b. Relay control panel shall be available in a minimum of four sizes: 4, 16, 30 and 42 relay outputs.
 - c. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - d. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type with visual indicator of relay status.
 - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments, low voltage, LED or ballasts; 20 A, 277-V ac for low voltage or ballasts.
 - c. Endurance: Minimum 30,000 cycles at rated capacity.
 - d. Mounting: Provision for easy removal and installation in relay cabinet.
 - e. Relay shall include a mechanical means of turning the relay on or off without the need of electrical power of any kind.
3. Two-Pole Relays or Contactors: Shall be of the same design and manufacture as single-pole relays with the same type of features with the addition of the following:
 - a. Contactors shall be individually UL listed and shall bear labels indicating compliance.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, for the control of 208, 240 and 480VAC loads.
 - c. Poles within the contactor shall be electrically isolated, but mechanically linked so as to open and close together without the possibility of one pole being closed while

the other remains open. Systems that utilize two single-pole relays to accomplish this function are not acceptable.

4. Dry Contact Interface Module: Manufacturer shall offer a programmable interface module for control from separately provided dry contact devices.
 - a. Module shall accommodate a minimum of 4 individual dry contact inputs.
 - b. Each input shall be individually programmable to control any single relay or groups of relays or contactors.
 - c. Module shall accommodate 2 and 3 wire devices, momentary or maintained.
 - d. Module shall be topology free, polarity insensitive, 2-wire network communication with "open system" communications architecture.
 - e. Module may be programmable for active or inactive time periods.
 - f. Mounting: Provision for easy removal and installation in relay cabinet.
5. Emergency Bypass Control/Relay(s):
 - a. Where an emergency power system is available and plans indicate control of emergency lighting via network lighting controls, provide U.L. 924 Listed emergency bypass relay(s) to illuminate emergency lighting from emergency power system during a normal power outage. Automatic controls shall be "bypassed" during emergency operation.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

2.5 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary-contact, low-voltage type furnished with system.
 1. White with matching faceplate.
 2. Number of buttons as indicated on floor plans (or schedule) for selection of scenes and/or lighting zones/levels.
 3. Integral green or red LED pilot light to indicate when circuit is on.
- B. Manual, Maintained or Momentary Contact, Full- or Low-Voltage Switch as indicated on drawings: Comply with Division 26 Section "Wiring Devices."
- C. Wall Plates: Single or multi-gang plates as required by manufacturer. Coordinate backbox size required with push-button switch(es) and wallplate.
- D. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. **18** AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. **14** AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category **5e** for horizontal copper cable.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
- F. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Test for circuit continuity.
 - 2. Verify that the control module features are operational.
 - 3. Check operation of local override controls.

3.3 SOFTWARE INSTALLATION

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

END OF SECTION 26 0943

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SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include 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.
- C. Panelboard schedules for installation in panelboards.
- D. Operation and maintenance data.

1.3 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 NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and/or surface-mounted cabinets, as indicated on the drawings.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

- b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
 - B. Incoming Mains Location: Top and/or bottom as Project condition dictates.
 - C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
 - D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
 - F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
 - H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cutler-Hammer.
 - 2. Siemens.
 - 3. Square D.
 - 4. General Electric (GE).
- 2.2 DISTRIBUTION PANELBOARDS
- A. Panelboards: NEMA PB 1, power and feeder distribution type.
 - B. Doors: Secured with vault-type 3 point latch with tumbler lock; keyed alike.
 - C. Mains: Circuit breaker, Lugs only as identified on the drawings.
 - D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker and/or lugs only as identified on the drawings. Sized to have 225 amp bussing unless indicated otherwise on drawings.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Sized to accommodate a minimum of 42 poles unless indicated otherwise on drawings. Furnish number/ampacity/poles of breakers shown.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents listed on the drawings.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles. Where more than one pole is used, they shall employ a common trip.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits. Type HACR for feeding heating, air conditioning and refrigeration equipment.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of lighting and appliance panelboard trim 72 inches above finished floor; distribution panelboard trim 90 inches above finished floor, unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges and ground fault settings as applicable.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room, area or equipment designations. Temporary conditions of occupancy shall not be utilized as circuit descriptions. Indicated spare circuits shall be specifically labeled as such. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 2416

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SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and interior occupancy sensors.
 - 6. Communications outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 5351 (single), 5352 (duplex).
- b. Hubbell; 5361 (single), 5362 (duplex).
- c. Leviton; 5351 (single), 5352 (duplex).
- d. Pass & Seymour; 5361 (single), 532 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. All receptacles installed outdoors shall be weather resistant type.
- C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; VGF20.
 - b. Pass & Seymour; 2085.
 - c. Leviton; 7899.
 - d. Hubbell; GF20.

2.4 TAMPER RESISTANT STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, NEC 517.18 and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300 (duplex).
 - b. Hubbell; HBL8300 (duplex).
 - c. Leviton; T7899 (duplex).
 - d. Pass & Seymour; TR26362 (duplex).

2.5 TAMPER RESISTANT STRAIGHT BLADE GFCI RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, NEC 517.18 and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFR5362 (duplex).
 - b. Leviton; T7899 (duplex).
 - c. Pass & Seymour; 2095TR (duplex).

2.6 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.7 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. Unit listed and compatible for type of lighting controlled and rated for connected load unless larger rating is indicated for future capacity.
- B. Control: Continuously adjustable slider, with separate on-off switch; single-pole or three-way switching capability. Comply with UL 1472.
- C. LED Line Voltage Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
- D. LED Low Voltage Dimmers: 0-10V control. On-off switch positions shall bypass dimmer module.

2.8 OCCUPANCY/VACANCY SENSORS

- A. Wall-Switch Sensors:
 - 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, manufacturer shall match that submitted for ceiling mounted occupancy sensors.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.. Device shall be capable of setting in “Occupancy or Vacancy” Mode. Set devices to mode indicated on the drawings.
4. Combination Vacancy Sensor/Dimmer shall have integrated components of vacancy sensor and dimming control in one single-gang device, both line and low voltage dimming as room lighting specified dictates.

2.9 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Nylon, color to match device.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.
 1. Outdoor receptacle covers shall be “In Use” type rated “Extra Duty”.

2.10 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, black finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: As noted on plans or as indicated in applicable specification section.

2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices: White, unless otherwise indicated or required by NFPA 70 or device listing. Switches, receptacles and coverplates for emergency (Life-Safety) lighting shall be RED.
 2. Device plates: Nylon, to match color of wiring devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. 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 the 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.
 - 5. All 15 or 20 amp-120V wiring devices located within 6 feet from the edge of a sink, located in Kitchens or Bathrooms or serving electric water cooler shall be GFCI protected type device.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 3. 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 all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 3. When there is a choice, use side wiring with binding-head screw terminals.
 - 4. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 5. Tighten unused terminal screws on the device.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches served from the same panel/system under single, multigang wall plates.

3.2 "PLUG CONNECT/PLUG TAIL" DEVICES

- A. In lieu of terminal screw connected receptacles and switches as specified above, specialized plug-in type devices may be provided as long as it is offered by the same manufacturer and listed equivalent to the same product line specified. Permanent wiring pigtails shall be of sufficient length to enable replacement of device with standard terminal screw type device as required by Code.
- B. Where plug-in type wiring devices are provided, furnish a minimum of five (5) of each type and color device installed to the Owner as spares. Where more than one hundred (100) of any type is installed, provide a minimum of ten (10) spare devices.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in, enclosed switches, panelboards, enclosed controllers and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper Bussman, Inc.
 - 2. Mersen.
 - 3. Littelfuse.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Feeders: Class RK1, time delay.
- B. Motor Branch Circuits: Class RK1, time delay.

- C. Other Branch Circuits: Class RK1, time delay.
- D. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 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/NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cutler-Hammer.
 - 2. Siemens.
 - 3. Square D.
 - 4. General Electric (GE).
- B. All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.
- C. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses specified when so indicated on

the drawings, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. 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 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cutler-Hammer.
2. General Electric Company.
3. Siemens.
4. Square D.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. 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. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
5. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. 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 6'-0" A.F.F. unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Install fuses in fusible devices.
- D. Coordinate location of devices to allow working clearances and to avoid interference with other equipment and trades.
- E. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

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SECTION 26 2913 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
 - 1. Across-the-line, manual and magnetic controllers.
- B. Refer to "Disconnect Switches" section for switch requirements.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.
- D. Motor starters and disconnects shall be manufactured and rated in accordance with NEMA, UL and IEEE Standards. IEC rated contactors and overloads are not acceptable.

1.3 COORDINATION

- A. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allen-Bradley Co (Bulletin 509)
 - 2. Cutler-Hammer (Class AN16).
 - 3. Siemens (Class 14).

4. Square D Type S (Class 8536).
5. General Electric (300 Line).

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED." Manual Controllers furnished for fractional horsepower, single phase motors unless otherwise indicated on plans.
 1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated. Provide Magnetic Controllers on all motors one horsepower and greater or any 3 phase motor, unless indicated otherwise on plans.
 1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity. Provide fusing on control transformer primary and secondary, each phase, and grounded on the secondary.
 2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL. Provide fusible disconnect only where specifically indicated on the drawings or where required by Code.
 2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
 3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

2.3 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated.
 1. Outdoor Locations: NEMA 250, Type 3R.

2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, LED Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. A Hand-Off-Auto selector switch shall be mounted in the face of each starter enclosure. The selector switch shall be so wired that when it is in the Hand or Auto position, all safety controls are wired in series with the selector switch. All control devices shall be wired in the Auto position only.
- D. Provide a green LED pilot light mounted in the face of enclosure. Wire pilot light so that light will be on when motor is energized.
- E. Provide a red LED pilot light mounted in the face of enclosure. Wire pilot light so that light will be on when starter power supply is energized.
- F. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock control circuit open.
- G. Control Relays: Auxiliary and adjustable time-delay relays. Provide adjustable 0-60 second "on" time delay relay on starters where indicated on drawings and wire into the "Auto" position of the selector switch to delay starting.
- H. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting. Provide on all 3 phase motor starters 5 HP and larger; wire ahead of the H-O-A switch.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

3.2 INSTALLATION

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide floor set unistrut frame to mount adjacent to equipment being controlled. Allow proper service clearances to equipment.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.3 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Bundle, train, and support wiring in enclosures.
- B. Install all other control and interlock wiring in the field that cannot be factory pre-wired and is indicated on the plans or other specification sections as wired by the Electrical Contractor.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
 - 3. Test electrical phase rotation of 3-phase supply feeders.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Correct malfunctioning units and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 2913

SECTION 26 3214 – ENGINE GENERATORS (EMERGENCY POWER SYSTEM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a standby power system to supply electrical power in event of failure of normal supply consisting of a liquid cooled engine, an AC alternator with main breaker and system controls, fuel system including fuel piping, exhaust system with muffler and piping and cooling sub-system and emergency power distribution. Refer to the drawings for capacities and electrical characteristics.
- B. The electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested as a complete unit, on a representative engineering prototype model of the equipment to be sold.
- C. See Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
- D. Manufacturer shall provide startup services, operational load test and demonstration to Owner as outlined in Parts 3.2 and 3.3.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1.
- E. Comply with NFPA 37.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 101.
- I. Comply with NFPA 110 requirements for Level 2 emergency power supply system.
- J. Comply with UL 2200, package unit shall be listed and labeled.

- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- L. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 year(s) from date of final acceptance of installation and beneficial use of system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The generator set shall be of standard design with complete factory assembly by Cummins (Onan), CAT or Kohler.

2.2 ENGINE-GENERATOR SET

- A. The engine set shall be multiple cylinder, 4 cycle, water cooled, natural gas/propane fueled developing not less than KW rating indicated on the drawings at a governed speed of 1800 RPM at an ambient temperature of 100 degrees F., and an elevation of 1000 ft. above sea level. Engine shall have an electronic isochronous governor to maintain speed regulation within 0.5% from no load to full load. Lubrication shall be integral pressure type. Engine assembly shall be complete to with all accessories including intake air filter, lubrication oil filter(s), fuel filter with electric fuel shut-off valve, RFI suppression, flexible fuel line connection, acid resistant battery box, battery cables, stainless steel flexible exhaust connection, critical grade silencer and 120 volt – 1 phase AC engine block heater with integral thermostat. Engine starting shall be accomplished by 12 volt battery system.

- 2.3 Generator shall be direct connected to engine crank shaft, with automatic voltage regulation within plus or minus 2%. Generator to include auxiliary field and voltage stabilizer to assure favorable motor starting characteristics. Frequency shall be tightly controlled with power factor of 0.80. Generator shall be self ventilated of drip-proof construction meeting NEMA, AIEE and ASA standards for temperature rise and vibro-mounted with less than 10% vibration transfer from unit to floor.

2.4 OVERCURRENT PROTECTION, INSTRUMENTATION AND ALARMS

- A. The Main Line Breaker(s) shall be generator mounted, molded case thermal magnetic trip, 100% rated type for load circuit breaking and line protection. Provide 600A/2P circuit breaker to serve Life-Safety ATS and 400A/2P circuit breaker to serve Standby Power ATS. Generator breaker(s) shall be mounted at NEC required accessible height from finished grade.
- B. Control panel shall be microprocessor based and shall be mounted on generator frame (with vibration isolators) and shall include the following:
1. Oil pressure gauge and alarm light (pressure gauge can mount on engine).
 2. Water temperature gauge with high temperature alarm light (temperature gauge can mount on engine).
 3. Running time meter.
 4. Voltmeter with selector switch, phase to phase, phase to neutral and off.
 5. Ammeter with selector switch, each line and off.
 6. Frequency meter.
 7. Battery charging ammeter.
 8. Over crank reset button.
 9. Unit auto-run-stop with remote start from automatic transfer switch.
 10. Voltage level adjustment rheostat (can mount on engine).
 11. Safety shut offs for high water temperature, low oil pressure, over speed and engine over crank; fault light and alarm contact for each.
 12. Indication of all alarms required by NFPA 110; include provisions for remote annunciation.
 13. All status/alarm lights shall be long-life LED style lamps.
- C. Surface mounted remote annunciator(s) with individual annunciation/LED lights of all alarms required by NFPA 110. Include red and green LED lamps indicating position of each automatic transfer switch.

- D. Provide ModBus communications protocol and communications points to enable remote monitoring of all generator status and alarm conditions via the building network (with password protected access).

2.5 ACCESSORIES AND WEATHERPROOF HOUSING

A. Furnish and connect the following engine accessories:

1. Heavy duty 12 volt lead acid starting battery and charger with an adjustable trickle charge rate and a high charge rate. Battery charger shall include a DC ammeter and voltmeter, AC circuit breaker and a DC fuse, 0-24 hour equalizing timer, AC power failure relay and low DC voltage alarm relay; LaMarche Model A-46 in NEMA 1 enclosure or equal by Charles Industries (Model AE) or by gen-set manufacturer. The battery shall not be discharged through the battery charger. Provide battery box.
2. Flexible stainless steel exhaust connection.
3. Critical type exhaust silencer, Maxim #M51 or equal by Burgess, EM Products Inc., Universal "ENS", York "Y4" or Cowl. Provide crossover manifold where engine has more than one exhaust outlet. Provide ventilated roof/wall thimble to accommodate exhaust piping.
4. A gas regulator (rated for 1 lb. delivery gas pressure) with pressure gauge on inlet, fuel shut-off solenoid valve and fuel strainer shall be furnished with the unit. Gas line and connections shall be made by the by the Plumbing Contractor, includes a manual (padlockable) shut-off valve, dirt leg and union.
5. Provide connection point, manual valving, tee fitting, regulator, etc. to accommodate manual external connection and manual transfer to a portable propane fuel storage tank system.
6. Integrally mounted cooling system radiator (with overflow reservoir) and belt driven fan with guard.

B. Provide a factory installed weather protective type sound attenuating (75 db at 7 meters) housing around generator for outdoor installation (Skin-Tight Enclosure). Standard features associated with housing shall be as follows:

1. Hinged and removable side and rear panels for easy access to generator set.
2. Vertical outlet hoods with 90 degree angles and baffles or turning vanes to redirect air and reduce noise; UL 94 HF1 listed acoustic insulation for flame resistant standards.
3. Louvers on both the generator air intake and radiator air discharge ends for cooling; to prevent rain and snow entry.
4. Lockable latches on each removable or hinged panel; all parts of latches and hinges and mounting hardware shall be stainless steel.

5. Rugged galvanized steel or aluminum construction; painted with accepted manufacturer's painting process. Skid mounted. Color shall be Manufacturer's Standard color for generator housings.
 6. Engine Block heater, 120 volt thermostatically controlled.
 7. All 120V accessories that are hardwired (not cord and plug connected), shall have local toggle-type disconnect ahead of connection to allow for easy servicing/replacement. Disconnect shall be in weatherproof cast aluminum box with weatherproof cover.
 8. Insulated critical rated silencer with tail pipe and rain cap; mount silencer inside generator enclosure.
 9. Rodent barriers and insect screens over all openings including louvered openings.
 10. Provide a 20A-120V convenience receptacle and switchable service light inside enclosure adjacent to service door. Receptacle shall be weather-resistant listed GFCI type receptacle in surface mounted weatherproof box with weatherproof cover. Service light shall be vaportight glass globe lampholder with exterior cast aluminum guard. Provide LED type lamp in fixture (equivalent lumen output to 60 watt incandescent). Switch for fixture shall be in cast aluminum weatherproof box with weatherproof cover. Service receptacle and light shall be wired from battery charger circuit.
 11. Provide additional 20A-120V convenience receptacle inside enclosure wired to separate/dedicated 20A-120V circuit for future enclosure heater accessories.
- C. Provide seismic spring isolators for generator assembly, rated for Seismic Use Group IV, Design Category C. Coordinate installation and provide generator pad requirements for the Electrical Contractor.

2.6 SUBMITTALS

- A. Equipment supplier shall submit for approval shop drawings, include recommended fuel piping diagram, interconnection diagram showing all controls and alarms and wiring requirements. Dimensioned drawings of the complete generator assembly including floor/isolation pad, isolators, main breaker location and lug size, exhaust connections, inlet/exhaust shrouds, required clearances, exhaust assembly, batteries and rack, etc. Shop drawings submitted without all required information will be rejected. At the completion of the project, these drawings shall be included as part of the maintenance manuals, these drawings shall be specific to the actual project installation and shall not be standard manufacturer model drawings.
- B. Housing paint color shall be Manufacturer's Standard color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110. Confirm installation will allow full access, without removing connections or accessories, for periodic maintenance.
- B. Deliver generator to Project Site and set unit on concrete pad.
- C. E.C. Installation requirements: Install packaged engine generator on minimum 6" thick concrete pad. Bolt skid firmly to seismic isolators and concrete pad utilizing concrete expansion anchors, stainless steel nuts/bolts with lock washers. Coordinate installation requirements with Manufacturer.
- D. Make external connections to generator and engine thru flexible connections.
- E. Connect auxiliary systems all in accordance with manufacturer's specific instructions for automatic and manual operation.
- F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems." Provide signs at service entrance location and at grounding location per NEC 700.7.
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Furnish and install all control wiring and interlocking between the engine-generator, generator control panel, automatic transfer switch(es), remote annunciator, auxiliary systems, etc.
- H. Fill radiator and cooling system with the necessary solution of ethylene glycol, additives and water for freeze and engine component/cooling system protection as recommended by the manufacturer. Provide freeze protection rated to -40 degrees F.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections prior to start-up and to assist in testing.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start unit(s) to confirm proper motor rotation and unit operation.
- D. Operational/Load Test:
 - 1. Adjust, test and demonstrate proper operation of the system after installation. Test shall demonstrate automatic operation, transfer, quick start, 100 percent block load pick-up and

a minimum of 4 hours endurance at full load. Coordinate location of load bank with Owner and other trades to ensure safe operation of systems and protection of surrounding areas. Engineer may require extended test time if system is deemed suspect.

2. Engine-generator system shall pick up full load in less than 10 seconds.

- E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. The supplier shall furnish a certified full load test certificate verifying that the generator has been tested prior to delivery and found to be in satisfactory working condition under test loads.
- G. Provide sign at the service entrance indicating type and location of on-site legally required standby power sources per NEC 701.9. Coordinate with Authority Having Jurisdiction (AHJ).

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generator, allow a minimum of 2 hours for training.

END OF SECTION 26 3214

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SECTION 26 3623 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes automatic transfer switches rated 600 V and less.

1.2 GENERAL

- A. Furnish and install electrically operated automatic switches to transfer loads to life-safety and standby system upon failure of main source of electricity. Unit shall be complete with accessories in NEMA 1 enclosure as shown on the drawings.
- B. Switch shall be electrically operated, mechanically held type with a mechanical interlock to prevent both sides closing simultaneously.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 70.
- D. Comply with NFPA 99.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Cummins (Onan) or equivalent by Kohler (GE-Zenith ZTS Series) or CAT.
- B. Automatic transfer switches shall be provided by the Generator Manufacturer, shall be responsible for and shall be Warranted as a package by the Generator Manufacturer.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated. Life-Safety Transfer Switch shall be rated at 100 Amps/3 Pole, Standby Power Transfer Switch shall be rated at 800 Amps/3 Pole.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the available fault conditions indicated on the drawings, based on testing according to UL 1008. Minimum Short Circuit Rating of 22,000 Amps Interrupting Current.
- C. Microprocessor Controls: Microprocessor based controller with Control and Display Panel mounted on face of door, panel shall have LED source and switch indication lights and membrane interface panel for test and time delay bypass controls.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- H. Neutral Terminal: Solid and fully rated with lugs, unless otherwise indicated.
- I. Enclosures: General-purpose NEMA 250, Type 1 complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 FEATURES AND ACCESSORIES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Signal-Before-Transfer Contacts: Two sets of normally open/normally closed dry contacts (rated 3 amps at 480 volts AC) operates in advance of retransfer to normal source (and in

advance of transfer to emergency source when in test mode). Timer intervals adjustable from 0 to 20 seconds for transfer in either direction and independently adjustable/programmable.

- D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- E. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
- F. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.
- G. Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 15 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: To simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate indicating "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate indicating "Emergency Source Available."
 - 8. All pilot/indication lights shall be LED type for long life.
 - 9. Unassigned Auxiliary Contacts: Four normally open/normally closed, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 10. Terminal provisions for connection of remote test and serial communications port for remote monitoring/annunciation.
 - 11. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Microprocessor based, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 14 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall Mounted Switch: Utilize appropriate brackets or inserts.
- B. Identify components according to Division 26 Section "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
 1. Connect automatic transfer switch(es) to initiate cranking of the emergency generator and to provide remote indication where specified or indicated on the drawings. Include installation of all wire and conduit associated with each automatic transfer switch.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Coordinate tests with tests of generator and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Arc Flash Evaluation Studies are required to be made by the Standby Generator manufacturer. The Manufacturer shall provide the appropriate labels to the automatic transfer switch.

3.4 WARRANTY

- A. Provide 2-year warranty (Parts and Labor). Provide the certificate directly to the Owner accompanied by a letter of transmittal. Provide a copy to the Engineer with shop drawings.
- B. Warranty shall start upon final acceptance of system installation and beneficial use of equipment.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate transfer switch(es) and related emergency standby equipment.

END OF SECTION 26 3623

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SECTION 26 4313 – SURGE PROTECTIVE DEVICES (SPD) FOR LOW-VOLTAGE ELECTRICAL
POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes SPD's for low-voltage power equipment.

1.2 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer. Manufacturer shall have been engaged in the manufacture of SPD products specified and products shall have been in satisfactory service for not less than 5 years.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- D. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- E. Comply with UL 1283 5th Edition, "Electromagnetic Interference Filters," and UL 1449 3rd Edition, "Surge Protective Devices."

1.3 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, non-condensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies, Inc.
2. Current Technology, Inc.
3. Cutler-Hammer, Inc. (Clipper)
4. Liebert Corporation.
5. Siemens Energy & Automation, Inc.
6. Square D.
7. General Electric (GE).

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Fuses/circuit breaker, rated at 200-kA interrupting capacity.
 4. Integral disconnect switch or circuit breaker to isolate entire suppressor components for repair/replacement.
 5. Redundant suppression circuits.
 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: 150kA per mode (300 kA per phase).
- C. Connection Means: Permanently wired.
- D. SPD and overcurrent/disconnect device shall have a short circuit current rating greater than that available on the electrical system.
- E. Protection modes and UL 1449 voltage protection rating compatible with system voltage and configuration as indicated on the drawings for complete protection as follows:
1. Line to Neutral.
 2. Line to Ground.
 3. Neutral to Ground.

2.3 PANELBOARD SUPPRESSORS

- A. Same characteristics and requirements as service entrance suppressors with the following exceptions:
- B. Surge-event operations counter not required.
- C. Peak Single-Impulse Surge Current Rating: 65kA per mode (130 kA per phase).

2.4 ENCLOSURES

- A. NEMA 250 (or better), with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible (not to exceed 18 inches). Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Twist input conductors together to reduce system inductance.
 - 1. Provide multipole circuit breaker or fusible disconnect switch as a dedicated disconnect for suppressor, fuse size and type as recommended by SPD manufacturer.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field tests and inspections and document on test reports:
 - 1. Complete startup checks according to manufacturer's written instructions.

END OF SECTION 26 4313

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SECTION 26 5113 - INTERIOR LIGHTING FIXTURES AND DRIVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, light engines (LED's) and drivers.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers for LED fixtures.
- C. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including occupancy sensors, and multi-pole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and photometric data.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. LED Fixtures: Fixtures with LED light source are noted on lighting fixture schedule with advertised lumen output of light source for fixture/manufacturer specified on schedule. Listed equal manufacturer shall provide fixture with equivalent lumen output as listed product. If insufficient information is provided, the Engineer may require Project Specific, point-by-point photometric calculations of sample areas utilizing the submitted fixture to prove equivalent performance.
- D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- E. Utility Company Energy Rebate Programs
 - 1. LED lighting fixtures shall be Energy Star or DLC listed to comply with local Utility Company Rebate Programs. Does not apply to track lighting fixtures. Fixture submittals that do not have either of these listings clearly indicated in the product data shall be rejected.
- F. Lamp Product Data: At Project Closeout, provide a summary sheet documenting average mercury content of all lamps provided under this project. Include summary sheet in the O&M Manual(s) provided for the Owner.
- G. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. All LED fixtures and components shall be tested and comply under the standards of IESNA LM-79-08, LM-80-08, LM-82-12 and TM-21-11 for measurement and publication of projected long term lumen maintenance, color stability, photometric performance and LED source operating lifetime.

1.4 WARRANTY

- A. Provide a written, five year replacement material warranty for defective or non-starting LED source assemblies. Warranty period shall begin on date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Lighting Fixture Schedule the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified on drawing schedule.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with UL 1598 and NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. 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.
- E. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Tempered glass, unless otherwise indicated.

F. Disconnecting Means:

1. Lighting fixtures with luminaires that utilize fluorescent double-ended lamps and contain ballast(s) that can be serviced in place or ballasted luminaires that are supplied from multi-wire branch circuits and can be serviced in place shall have a local disconnecting means at/within the fixture complying with NEC Article 410.130(G).

2.3 DRIVERS

A. Drivers for LED Light Sources:

1. Driver shall be separate component from LED light source and shall be replaceable utilizing mounting screws, factory provided clips and electrical connector bodies, except for integral downlight and utility light fixtures specified as one assembly.
2. Dimming (When noted or indicated on Fixture Schedule): 100 to 1 percent of rated lumens via separate 0-10V input (Dimmer) control. Line voltage dimming acceptable when noted on plans.
3. Level Control/Step-Dimming (When noted or indicated on Fixture Schedule): Minimum capability of bi-level control (100%-50%-Off) or 1/3-2/3-Full on, as noted.
4. Voltage input: 120 Volt.

2.4 EXIT SIGNS

A. Internally Lighted Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Voltage input: 120-277 Volt multi-volt capability.

2.5 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. 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.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Voltage input: 120 Volt.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Recessed fixtures shall be supported at all 4 corners, independent of each other, from structure above with steel #12 single jack chains. Additionally, securely fasten each fixture to the ceiling framing member by mechanical means such as bolts, screws, rivets or approved clips; install a minimum of one on each four sides of fixture.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Single or Continuous Rows: Provide manufacturer required quantity of suspension cables at minimum intervals to support continuous row fixtures. The E.C. shall support suspended fixtures independently from the ceiling system and as specified by the fixture manufacturer.
- D. Surface or Flush Lighting Fixture Support:
 - 1. The E.C. shall coordinate fixture locations with the trade installing the ceiling system to assure support members are oriented and located to accommodate the lighting fixture layout.
 - 2. Surface or flush fluorescent fixtures in ceilings of the suspended lay-in type shall be installed so that the long dimension of the fixture is supported on the main support members of the ceiling system.
- E. Luminaires installed in exposed or concealed locations under metal corrugated sheet roof decking shall be installed and supported so there is not less than 1-1/2" measured from the lowest surface of the roof decking to the top of the luminaire.
- F. Adjust aimable lighting fixtures to provide required light intensities.
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Where applicable, verify transfer from normal power to battery and retransfer to normal.

3.3 SPARE LAMPS/FIXTURES

- A. For LED lamps, Par style, provide a minimum of five (5) of each type. These lamps are not to be utilized as replacements for lamps that have failed prematurely while in use during construction and prior to turnover for beneficial use.
- B. For LED fixtures with LED source integral to the fixture assembly, provide one spare fixture for each type specified or as noted on lighting fixture schedule (this does not include exterior lighting fixtures).

END OF SECTION 26 5113

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SECTION 26 5200 – EXIT AND EMERGENCY LIGHTING

PART 1 - GENERAL

- 1.1 Exit lighting and emergency lighting system wiring shall be run in conduit system which is completely independent of normal wiring systems.

PART 2 - PRODUCTS – N/A

PART 3 - EXECUTION

- 3.1 Install a green ground wire throughout the wiring system.

END OF SECTION 26 5200

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SECTION 26 5600 – EXTERIOR AREA LIGHTING

PART 1 - GENERAL

- 1.1 Work includes complete new exterior lighting including luminaires, lamps, poles, bases, conduit, conductors, fusing, control devices, etc. as shown on the drawings. Include all excavation, backfill, concrete bases and encasement of underground conduits as detailed on the drawings.

PART 2 - PRODUCTS

- 2.1 Refer to data on the drawings for fixture details.

PART 3 - EXECUTION

- 3.1 Concrete bases for standards shall be round extending above finish grade as detailed on the drawings with rounded corners and rubbed finish. Furnish anchor bolts as recommended by the manufacturer. Concrete bases shall be poured-in-place at the job site; steel reinforced concrete, minimum 3500 lb. test.
- 3.2 Provide a surge arrester behind the handhole in pole base of each lighting standard and connect to each phase conductor and 0.625" diameter by 10 ft. long copper clad driven ground rod providing a good grounding path. Connect the equipment grounding conductor to this grounding terminal. A separate ground rod is required for each lighting standard exceeding 15 ft. in height. Surge arresters shall be Square D Series SDSA, Joslyn Model Series 1250 or G.E. 9L15E and F Series. Install per NEC Article 280.
- 3.3 Provide Buss "KTK" fuses in HEB waterproof in-line holder ahead of the ballast in each "hot" leg; locate behind handhole in pole base.
- 3.4 Consult manufacturer of pole and fixture(s) for recommended installation methods.
- 3.5 Mount standards truly vertical. Shim and grout under fixture base to level standards, visible shims are not acceptable. Provide anchor bolt covers.
- 3.6 Splicing shall be made with approved and UL Listed, waterproof splicing kits and shall be located in base of poles behind handhole or in splice box if indicated on plans.
- 3.7 Install a green ground wire throughout the underground wiring system and bond to all standards.

END OF SECTION 26 5600

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SECTION 26 6101 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers fire alarm systems, including initiating devices, notification appliances, controls and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm and detection operations.
 - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems and other equipment as indicated in the drawings and specifications.

1.2 Acceptable Manufacturer

- A. Manufacturer: The equipment and service described in this specification are those supplied and supported by Notifier (by NESCO), whose catalog numbers are used herein for establishing equipment criteria. Other acceptable manufacturers are Cerberus Pyrotronics, Mircom or Silent Knight.
- B. Equipment manufacturer shall have a service organization within 60 miles of the project site and be a U.L. certified company. All equipment and materials necessary for proper operation of the system shall be deemed part of these specifications even if not specifically listed or described in this document.

1.3 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 and 26 Specification Sections, apply to this section.
- B. The work covered in this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 26: "Common Work Results for Electrical."
 - 2. Division 26: "Control Voltage Electrical Power Cables."
- C. The system and all associated operations shall be in accordance with the following:
 - 1. Guidelines of the following Building Code: BOCA
 - 2. NFPA 72, National Fire Alarm Code

3. NFPA 70, National Electrical Code
4. NFPA 101, Life Safety Code
5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.4 System Description

- A. System shall be a microprocessor based, double supervised, closed circuit fire alarm system of modular design utilizing addressable technology for remote devices. Wiring shall be Class “B” for signaling and notification circuits. Smoke detectors shall be analog, addressable units with control panel adjustable sensitivity. All equipment shall be labeled by U.L. for fire alarm signaling use.
- B. Operation of any addressable manual or automatic fire alarm initiating device (including monitoring device(s) connected to line voltage sleeping room/corridor combination smoke/CO detectors) shall initiate the following:
 1. Sound a Code-3 temporal pattern audible alarm signal (pattern programmable at the main panel) and illuminate fire signal lights (strobes) in a synchronous mode until alarms have been silenced. Alarm may be silenced at the main fire alarm system control panel or at a remote annunciator panel by means of an “alarm silence” switch or if the initiating device returns to normal and a system “reset” switch is manually actuated.
 2. Display the alarm condition on integral LCD display in the main control panel and remote annunciator(s). Display shall indicate the alarming device and its location. All alarm initiating devices shall be individually addressed.
 3. Print the assigned message with time and date at the control panel (or remote printer, if specified). Activate control-by-event functions listed in these specifications.
 4. Initiate a separate trouble and alarm signal for connection to remote monitoring service organization as directed by Owner.
 5. Release all electromagnetic door holders.
 6. Activate control relay(s) to disconnect power to high-volume-low-velocity suspended ceiling fans in apparatus bay.
- C. In the event of an operating power failure or an open or a grounded circuit in the system, a trouble signal and a trouble light shall be activated until the problem is corrected and the system is restored to normal. The trouble event shall be recorded in the system history log and printed on the system printer (when applicable). The trouble may be silenced by means of a button on the main control panel. Upon restoration of the system to a normal condition, the trouble light shall extinguish.

1.5 Submittals

- A. General: Submit one electronic copy (pdf format) of the following to the Architect/Engineer for review for conformance with the Bid Documents prior to submission to the AHJ for permit:
1. Product data sheets for system components highlighted or marked to indicate the specific products, features or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds or does not comply with this specification.
 2. Wiring diagrams from Manufacturer's Vendor.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details.
 4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor and auxiliary control circuits.
 6. Operating instructions for FACP.
 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses and telephone numbers of service organizations.
 8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with specified requirements.
- B. Submission to Authority Having Jurisdiction: After Architect/Engineer review of routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make re-submissions if required to make clarifications or revisions to obtain approval.

1.6 Quality Assurance

- A. Installer Qualifications: Installer(s) shall meet State of Ohio and local Municipality requirements for certification and as a minimum, have one installer certified as a NICET Level 2. In addition, the fire alarm system supplier shall have on staff, one NICET Level 3 certified individual and be an UL certified company.
- B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL Inc. and shall bear the UL label.

1.7 Extra Materials

- A. General: Furnish extra materials, packaged with protective covering for storage and identified with labels clearly describing contents as follows:

1. Strobe units: Furnish four (4) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
2. Horn/Strobe units: Furnish four (4) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
3. Smoke Detectors or Sensors: Furnish two (2) units.
4. Detector or Sensor Base(s): Furnish two (2) units of each type installed, plus 50 ft. of wire for each, installed at the Engineer's direction.
5. Pullstation(s): Furnish two (2) units, plus 50 ft. of wire for each device, installed at the Engineer's direction.
6. Addressable Circuit Interface Modules: Furnish four (4) units, plus 50 ft. of wire for each, installed at the Engineer's direction.

PART 2 - PRODUCTS

2.1 Control Unit

- A. Control unit shall contain all necessary components to provide complete control, testing and indicating facilities for the entire fire alarm system. Relays, where utilized, shall be pluggable type, sealed in dustproof containers to prevent failure from dust, dirt, tampering and accidental contact. Unit shall facilitate silencing of alarm from one addressable device and shall resound on subsequent alarm from another addressable device. Unit shall be double supervised, individually annunciated by addressable point with the following features: test switch, silencing switch(es), reset switch(es), control switch(es), power "on" lamp, minimum of 80 character LCD display, "Alarm" lamp and a means to simultaneously test all indicator lamps (LED's). "Trouble" signal shall be in integrally mounted alert signal with a SPL of 80 db at 4 ft. Trouble alarm silence switch (button) shall have ring back feature.
- B. An alarm shall be displayed on a two line, minimum 80 character LCD display. Display shall indicate alarms, supervisory service conditions and any trouble conditions. The top line of characters shall be the address/point label and the second line shall be the device type identifier. The system ALARM red LED shall flash on the main control panel and remote annunciator panels until the alarm has been acknowledged at any of the panels. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another point, after acknowledged, shall flash the system ALARM red LED on the control panels. The LCD display shall show the new alarm information. A pulsing alarm tone shall occur within the control panel and the remote annunciator panels until the alarm is acknowledged.
- C. The control panel shall be sized to accommodate 250 addressable devices, expandable to 2000 addresses thru the addition of Idnet card(s) within this control panel. Power supplies shall be supplied with 100% capacity including provisions for 10% additional strobe lights and 20% additional audible devices. Provisions for spare capacity shall include additional data loop cards or signaling cards to support the specified capacity. Audible signals shall be master controlled from the fire alarm panel or permit master coded signaling in a Code-3 temporal pattern, panel selectable without making any modifications to remote devices. All visual alarm signals (strobe lights) shall be synchronized at the fire alarm panel. Notifier NFS-3030 series with all necessary accessories.
- D. Cabinet shall be modular construction, shall be semi-flush mounted and shall accommodate all modules, cards, relays, terminal connections, batteries, etc., necessary for system operation. The outer door and frame assembly shall be equipped with a keyed lock and shall have a transparent

door panel to enable viewing all alarm and trouble lights, as well as LCD display, without opening door. Provide manufacturer's standard enamel finish.

- E. The control panel shall communicate individually with addressable initiating and control devices. Each device shall be individually annunciated at control panel.
 - 1. Annunciation shall include the following:
 - a. Alarm
 - b. Trouble
 - c. Open
 - d. Short
 - e. Device missing/failed
 - 2. All addressable devices shall be capable of being disabled or enabled individually.
 - 3. Smoke detectors shall utilize "Alarm Verification" operation.
 - 4. Smoke sensor sensitivity shall be field-adjustable from the control panel for the analog style detectors. Control panel shall have a self-test function such that each sensor is automatically tested once every 24 hours. Sensor shall notify control panel when maintenance is required. System shall automatically compensate for variations in environmental conditions.
- F. The control panel shall have a "Walk Test" feature.
- G. Operating power shall be supplied from a 120 volt, 60 Hz circuit while the supervisory power shall be supplied from an integral DC power supply. The low voltage DC power shall consist of power limited, filtered and regulated power supplies with maintenance-free, lead-calcium battery back-up with automatic recharger. Indication for normal power supply and power supply trouble shall be provided. Provide remote cabinet for batteries where size dictates need. Batteries shall be sized to maintain system operation, including trouble alarm, for 24 hours with sufficient reserve capacity to power all alarm sounding devices for 5 minutes. Battery capacities shall be sized to include provisions for the spare strobe light and audible devices in Para. 1.7. Door holders are not required to be maintained by the standby batteries. All batteries shall be supervised.
- H. Provide surge suppressors ahead of all 120 volt power connections to the fire alarm equipment. Locate suppressors within equipment enclosure or in a junction box directly above/adjacent to the unit. Suppressors shall be Leviton #51020-WM or equal. These suppressors are in addition to internal protection provided with the fire alarm system's internal electronics.
- I. Provide surge suppressors on all initiating and notification circuits that enter or leave the building to/from remote locations.

2.2 Remote System Components

- A. Miniplex transponders will communicate with the Main Fire Alarm Control Unit to provide for centralized control of alarm and trouble signaling as well as output signaling. The transponder shall be capable of limited stand-alone operation in the even the communication link to the central system is lost. Each transponder shall be furnished with all necessary controls, power supplies and battery back-up.

- B. Manual stations shall be addressable communicating devices, shall be non-coded, single action with break rod operation (glass rod not required to reset station), red finish semi-flush mounted with keyed reset switch. Notifier #NBG-12LX.
- C. Fire signal lights (strobe lights) for synchronized operation shall provide visual indication of all alarms and shall illuminate in a flashing mode whenever system is in alarm state. Fire signal lights shall be labeled in accordance with UL 1971 Standards and shall be 15 candela in corridors and 110 candela in all other areas unless specifically designated otherwise. Semi-flush mount signal lights on walls where shown on the drawings. Lens shall be installed in a horizontal alignment on a red back plate labeled "FIRE" and shall produce one flash per second. Strobes shall be Notifier-Gentex G.E. Series (for wall mount) or GC Series (for ceiling mount) with appropriate mounting hardware. Exterior units shall be gasketed and labeled for exterior use, Notifier-Gentex WGE Series (UL 1638 compliant).
- D. Horns shall be semi-flush mounted, with red grille and field selectable output levels of 85 or 91 dB at 10 ft. (based on UL 464 reverberant test requirements). Horn operating power levels shall be set initially at 85 dB and adjusted upward as required for proper sound coverage during the final check-out. Power calculations shall be made using the current draw for all units operating at 91 dB. Outside assemblies shall be weatherproof. Combination (audible/visible) horn and fire signal lights shall utilize a compact, combination mounting base assembly. Horns shall be labeled "FIRE". Notifier-Gentex GE Series (utilize the continuous horn signal setting) with mounting accessories. Exterior units shall be gasketed for weatherproof rating. Combination strobe/horn signal units shall be factory assembled, Notifier-Gentex GE Series.
- E. Combo horns with fire signal lights (strobe lights) for synchronized operation shall provide both audible and visual indication of all alarms and shall illuminate in a flashing mode whenever system is in alarm state. Fire signal lights shall be labeled in accordance with UL 1971 Standards and shall be 15 candela in corridors and 110 candela in all other areas unless specifically designated otherwise. Semi-flush mount horn/signal lights on walls where shown on the drawings. Lens shall be installed in a horizontal alignment on a red back plate labeled "FIRE" and shall produce one flash per second. Horns shall have a red grille with field selectable output levels of 85 or 91 dB at 10 ft. (based on UL 464 reverberant test requirements). Horn operating power levels shall be set initially at 85 dB and adjusted upward as required for proper sound coverage during the final check-out. Power calculations shall be made using the current draw for all units operating at 91 dB. All strobes shall be synchronized throughout the entire building utilizing control circuitry within the main fire alarm panel (and extender panels, if used). Exterior units shall be gasketed and labeled for exterior use, Notifier-Gentex GE Series (for wall mount) or GC Series (for ceiling mount).
- F. Surface mounted fire alarm devices mounted on walls-such as manual stations, horns, strobes, etc. shall utilize finished backboxes. These backboxes shall be red metal and shall be field punched for conduit entrance (boxes shall not be stamped KO construction).
- G. Individual addressable monitor module shall be an addressable module used for monitoring N.O. contact devices such as water flow, tamper switches, kitchen hood ansul system, sleeping room/corridor line voltage combination smoke/CO detectors, etc. Notifier #FMM-101.
- H. Programmable relay control module shall be an individual addressable module used for control of auxiliary functions such as door release, smoke damper activation, air handling unit shutdown, ceiling fan shutdown (power disconnect), etc. Notifier #FRM-1.

- I. Photo-electric type, addressable, ceiling mounted smoke detectors, shall utilize all solid state components operating on the light scatter principle and shall have adjustable sensitivity set at the transponder to detect smoke at 0.5% to 3.7% light obscuration per foot. The sensors shall communicate actual smoke chamber sensitivity to the system control where it is constantly monitored. Each addressable detector is individual adjustable thru the control panel and environmentally adjusted. The system will indicate when individual sensors need cleaning. Detector head shall have a white finish and contain an integrally mounted LED pilot lamp that indicates detector status. Notifier #FSP-851 with B710LP base. Provide remote LED alarm indicators when indicated on plans.
- J. Photo-electric type, addressable, duct mounted smoke detectors, shall utilize all solid state components operating on the light scatter principle and shall have adjustable sensitivity set at the transponder to detect smoke at 0.5% to 3.7% light obscuration per foot. The sensors shall communicate actual smoke chamber sensitivity to the system control where it is constantly monitored. Each addressable detector is individual adjustable thru the control panel and environmentally adjusted. The system will indicate when individual sensors need cleaning. Detector head shall have a white finish and contain an integrally mounted LED pilot lamp that indicates detector status. Notifier #FSD-751P. A remote LED "status" light shall be flush mounted at 54" mounting height in a convenient location within sight of air handling unit, Notifier #RA-400Z.
- K. Ceiling mounted heat detectors shall be addressable, combination rate-of-rise and fixed temperature type set to alarm at 135 degrees F. or on a temperature rise of 15 degrees F. per minute. Unit shall be capable of low temperature monitoring. Detector shall be white and low profile style, Notifier #FST-851 with #B710LP base.
- L. Waterflow switches shall indicate the continuous flow of water in sprinkler pipes where indicated on drawings. Unit shall be equipped with retard mechanism, adjustable up to two minutes, to minimize false alarms due to pressure changes. Retard mechanism and allowable time delay shall be subject to local AHJ requirements. Unit shall be supplied and installed by the Fire Suppression Contractor and wired to the fire alarm system by the E.C. via a monitor module with a dedicated address.
- M. Gate valve switches (OS&Y) shall monitor the status of sprinkler valves where indicated on drawings and shall signal a trouble alarm when respective valve is closed. Unit shall be supplied and installed by the Fire Suppression Contractor. Each gate valve switch shall be wired to the fire alarm system by the E.C. via a monitor module with a dedicated address.
- N. Magnetic door holders shall be multi-voltage selectable for 24 VDC or 24/120VAC operation. Flush wall mounted, Notifier #FM-998; semi-flush mounted, Notifier #FM-997 for new construction or surface wall mounted, Notifier #FM-996 for remodel applications on existing walls. Floor mount models for single door, Notifier #FM-980 or double door, two Notifier #FM-980, where shown on plans or application requires such use.
- O. Remote Annunciator and Operator Control Panels shall be flush wall mounted where shown on plans. Each shall consist of an 80 character LCD display with control features similar in appearance and orientation as the main fire alarm control panel. Control buttons shall be locked behind a window (keyed the same as the main fire alarm control panel) to prevent unauthorized operation.
- P. Notification appliance power extender control panels shall be provided where shown on the drawings. These panels shall communicate with and be completely supervised from the main

fire alarm control panel. They shall be capable of powering additional synchronized visual alarm signals (strobes) and/or audible alarm signal circuits. Each panel shall include supervisory modules, power supplies, batteries and chargers. At the Contractor's option, additional extender panels may be utilized if deemed acceptable by and locations are coordinated with the Architect/Engineer during the bidding phase. Notifier #FCPS-24 Series panel with accessories.

- Q. A digital communicator shall be located within the main fire alarm control panel to automatically transmit designated alarms and supervisory signals to a central station monitoring service via two dedicated outside telephone lines. Connection shall be coordinated with the Owner. The fire alarm panel shall indicate a trouble alarm on any digital communicator equipment failure (including loss of telephone line connection for longer than 45 seconds). The digital communicator shall be powered and maintained by the main fire alarm control panel standby battery power supply. Provide surge suppression on the 120 volt power supply and on both telephone lines. The E.C. shall coordinate with the Owner to ensure that the monitoring connection is in place and that network lines are connected and operational to allow programming and testing of the digital communicator.

The digital communicator shall transmit the following event level information:

1. Fire Alarm Condition
 2. Supervisory Condition
 3. Trouble Condition
 4. Daily Test Signal
- R. Provide a recessed Knox-Box rapid entry system where indicated on Architectural drawings. Extend wiring from the Knox-Box tamper switch to a monitor module to signal a trouble to the building fire alarm system.

PART 3 - EXECUTION

3.1 Installation, General

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

3.2 Equipment Installation

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes and all other necessary material for a complete operating system. Wall mounted devices shall utilize manufacturer recommended rough-in boxes with bushed conduit stubbed above accessible ceiling (as a minimum).
- B. If the building has a legally required standby power generator or power system, the E.C. shall provide a 20 Amp-120 Volt emergency circuit from the nearest Life-Safety emergency panel to the main fire alarm panel and any additional Notification Appliance (Power Extender) Panels required by the system.

- C. Coordinate door holder equipment connections and installation with door hardware supplier.
- D. Locate duct mounted smoke detectors per UL and manufacturer's guidelines for accurate air sampling and to permit easy access for maintenance and testing. Coordinate installation with the H.C. Where required, provide access panels. The E.C. shall ensure accessibility to the entire assembly.
- E. Provide a system smoke detector at the location of each fire alarm control unit (this includes the main panel and extender panels/auxiliary control panels where initiation/notification circuits originate).
- F. Provide monitoring/alarming of combination smoke alarm/CO detectors located in dormitory sleeping rooms/corridors. Smoke alarm/detectors shall be hardwired together to alarm as a standalone group as well as a separate zone to the building fire alarm system.

3.3 Wiring Installation

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electrical Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuit wiring and a different color code for supervisory circuits. Color code notification appliance circuits differently from alarm initiating circuits. Paint fire alarm system junction boxes, conduit fittings and box covers red.
- D. The following wiring and conduit shall also be included in the fire alarm system work:
 - 1. Empty conduit with pullwire from the digital communicator to the main telephone backboard. Telephone wiring from the telephone backboard to the digital communicator is the Owner's responsibility (or provided under a separate contract). The E.C. shall assist in making the final connections at the digital communicator and verify transmission and receipt by the Central Station prior to final testing.
 - 2. From duct mounted smoke detector, control relay module or fire alarm panel to each air handling unit and exhaust fan for shutdown where required by OBC (606).
 - 3. From electro-mechanical door holders to associated smoke detectors and/or fire alarm panel or control relay.
 - 4. Power supply wiring to suspended High Volume/Low Velocity circulation fans, thru control relay, to shut fan(s) down upon alarm condition.
 - 5. Wiring to supervisory monitor and control points.

- E. **Wire shall be installed in a separate and dedicated conduit system.**

3.4 Field Quality Control

- A. **Manufacturer's Field Services:** Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.
- B. **Final Test Notice:** Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing. Test the system according to the procedures outlined in NFPA 72.
- C. **Report of Tests and Inspections:** Provide a written record of inspections, tests and detailed test results in the form of a test log.
- D. **Final Test, Certificate of Completion and Certificate of Occupancy:**
 - 1. Test the system as required by the Authority Having Jurisdiction (AHJ) in order to obtain a certificate of occupancy.
- E. **Revise all wiring diagrams and floor plans to reflect final accepted "As-built" conditions for the project and include in the O&M Manuals for the owner's use. In addition, the supplier shall include an electronic copy of the system's operating program on a CD.**

3.5 Cleaning and Adjusting

- A. **Cleaning:** Remove paint splatters and other spots, dirt and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. **Occupancy Adjustments:** When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions, in compliance with NFPA 72. Provide up to three (3) visits to the site for this purpose.

3.6 Training

- A. **Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's designated personnel for a minimum of 4 hours training on-site.**

END OF SECTION 26 6101

SECTION 26 7000 - SUSPENDED CEILING MOUNTED CIRCULATION FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The fan shall be the models scheduled with the capacities indicated. The fan shall be furnished with mounting hardware and variable speed controls.

1.2 RELATED WORK

- A. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses and disconnect switches shall be provided by this contractor.

1.3 GENERAL ELECTRICAL REQUIREMENTS

- A. Wiring: Wiring practices, materials and coding shall be in accordance with the requirements of the National electrical Code NFPA 70 and other applicable codes and standards.

1.4 SUBMITTALS

- A. Product Data: For each Fan type indicated.
- B. Shop Drawings: Detail assemblies of equipment indicating dimensions, weights, components, and location and identification of each field connection. Show access, mounting, and clearance requirements; details of controls.
 - 1. Include wiring and installation diagrams.
- C. Operation and maintenance data.
- D. Warranties.

1.5 WARRANTY

The manufacturer shall replace any products or components defective in material or workmanship, free of charge to the customer in accordance to the following schedule:

- Motor 1 year (Parts)
- Controller 1 year (Parts)

PART 2 - PRODUCTS

2.1 Commercial Style, Large Area/High Bay Fans (Type CF1)

- A. Complete Unit:

The fan shall consist of entire unit with housing, motor, blades, drop rod, trim canopy, etc. Equal to Model/Series noted on the Plans.

B. Trim:

The fan shall be equipped with all White finish on housing with steel blades, minimum 52" diameter, maximum 60" diameter (White finish on blades).

C. Motor:

The fan motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed at 3 preset speeds (Low/Medium/High) and reversing (from wall control switch) without the use of a gearbox or other mechanical means of control. The motor shall operate at 120V/60 Hz. The motor shall be a non-ventilated, heat sink design with the capability of continuous operation in -40°F to 131°F (-40°C to 55°C) ambient conditions.

D. Mounting System:

The fan mounting system shall be designed for quick and secure installation from a standard octagon ceiling fan electrical box rated for a minimum of 50 lbs.

For mounting through ceiling media, a factory supplied canopy is provided to maintain a professional, finished installation.

E. Wall Control:

The fans shall be capable of On/Off/3-Speed/reversing control from a remote wall control. The wall control shall be capable of controlling a minimum of 3 fans mounted in a standard single-gang box with cover plate (which shall be included with the wall mounted device). The controller(s) shall be integrated and installed in Apparatus Bay Control Enclosure, refer to detail drawings

2.2 Residential Style, Small Room/Small Diameter Fans (Type CF2)

A. Complete Unit:

The fan shall consist of entire unit with housing, motor, blades, drop rod, trim canopy, etc. Equal to Model/Series noted on the Plans.

B. Trim:

The fan shall be equipped with all White finish on housing with reversible wood blades, minimum 36" diameter, maximum 42" diameter (White finish on blades).

C. Motor:

The fan motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed at 3 preset speeds (Low/Medium/High) and reversing (from switch on fan) without the use of a gearbox or other mechanical means of control. The motor shall operate at 120V/60 Hz. The motor shall be a non-ventilated, heat sink design with the capability of continuous operation in -40°F to 131°F (-40°C to 55°C) ambient conditions.

D. Mounting System:

The fan mounting system shall be designed for quick and secure installation from a standard octagon ceiling fan electrical box rated for a minimum of 50 lbs.

For mounting through ceiling media, a factory supplied canopy is provided to maintain a professional, finished installation.

E. Wall Control:

The fan shall be capable of On/Off/3-Speed control from a remote wall control. The wall control shall be capable of mounting in a standard single-gang box with cover plate (which shall be included with the wall mounted device).

EXECUTION

2.1 INSTALLATION

- A. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- B. Follow manufacturer's instructions regarding installation, wiring and testing system. Wiring shall be installed in conduit in accordance with manufacturer's recommendations and in compliance with local, state and national codes.
- C. Identify components and wiring according to Division 26 Section "Identification for Electrical Systems."

2.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fans.

END OF SECTION 26 70 00

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SECTION 26 7510 - DATA EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Grounding.

B. Related Sections:

1. Division 26 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies, and location and size of each field connection.
2. Equipment racks and cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of **RCDD**.
2. Installation Supervision: Installation shall be under the direct supervision of **Registered Technician**, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as **Commercial Installer, Level 2** to perform the on-site inspection.

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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

- D. Grounding: Comply with ANSI-J-STD-607-A.

1.4 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with security systems and LAN equipment suppliers and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of security systems and LAN equipment.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- B. Cable Ladder Rack:
 - 1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:**
 - a. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.
 - d. Cope - Tyco/Allied Tube & Conduit.
 - e. GS Metals Corp.
 - 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by **electroplated zinc galvanizing, complying with ASTM B 633, Type 1.**

2.2 EQUIPMENT RACKS

- A. Racks, rack wire management hardware, rack power strip(s) and rack mounted UPS(s) provided by Owner. Coordinate rack locations with Owner.

2.3 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.4 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless **compression** type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.5 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.2 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with

requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 1100

SECTION 26 7533 - RACEWAY AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for communications systems including voice, data, fire alarm and other remote-control, signaling and power-limited circuit systems.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, cable trays, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with ANSI/EIA/TIA 569.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel only, set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Brushed Aluminum with snap-on covers.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Hubbell Wiring Systems.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Single-gang deep box for wall-phone, minimum two-gang box with single-gang extension ring for all others.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets:
 1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Exposed Conduit: Rigid steel conduit.
 2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, 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: Rigid steel conduit. Includes raceways in the following locations:
 - a. Mechanical rooms: EMT.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT except FMC may be utilized in existing walls.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Damp or Wet Locations: Rigid steel conduit.
 7. Raceways for Optical Fiber or Communications Cable: EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.

- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of two 90-degree bends in any conduit run or .
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- H. 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.
- I. Raceways for Data, Audio Visual and Communications Cable: Install as follows:
 - 1. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
 - 3. Raceway shall be installed continuously from outlet box to above edge of nearest cable tray above accessible ceiling.
 - 4. Bond raceway to cable tray with approved grounding bushing, bonding jumper and necessary fittings.
- J. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in all locations except MC may be used for lighting fixture whips.
- K. 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.
- L. Set metal floor boxes level and flush with finished floor surface.

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 7561 – VOICE AND DATA COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling identification products.
7. Cabling administration system

1.2 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 3. Bridged taps and splices shall not be installed in the horizontal cabling.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Patch panels.

- b. Cross connects.
 - c. Patch cords.
- 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled for support of Category 5E and 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Communications Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 4 inches square, and 2-1/2 inches deep.

2.2 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Black Box.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6 for data.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - b. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - c. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - d. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.3 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. Panduit Corp.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables, utilize 48 port panels as a standard.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- F. Patch Cords: Factory-made, 4-pair cables in **48-inch** lengths; terminated with 8-position modular plug at each end.
 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.

2.4 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Data: Ortronics, Inc.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 1. Number of Terminals per Field: One for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. One for each four-pair UTP cable indicated.
 3. Mounting: Recessed in Floor or Wall as indicated on floor plans.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.5 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Data: Ortronics, Inc.
- B. Description: MUTOAs shall meet the requirements for cable connecting hardware.
 1. Number of Terminals per Field: One for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. One for each four-pair UTP cable indicated.
 3. Mounting: Recessed in Floor, Wall or Furniture.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.

2.6 DATA OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Two-port-connector assemblies mounted in single or multigang faceplate.
 - 1. Faceplate: White nylon, complying with requirements in Division 26 Section "Wiring Devices."
 - 2. For use with snap-in jacks accommodating any combination of UTP work area cords.
 - a. Flush mounting jacks, positioning the cord at a 180-degree angle.
 - 3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.7 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.8 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.9 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the Owner (Provided by Owner).

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and routed thru J-Hook/Bridle Ring System in accessible ceiling spaces. Conceal raceway and cables except in I.T. Room. All other areas shall utilize conduit system from workstation outlet to corridor cable management system.
 - 1. Install plenum rated cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. J-Hook/Bridle Ring System: Comply with TIA/EIA-569-A. Provide capacity for all new cabling to be installed plus 100% spare capacity. Provide tiered or tandem hooks as required.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Communications Systems" for installation of conduits and wireways. All low-voltage/communications cabling shall be installed in conduit within the Apparatus Bay, routed high to ceiling structure.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Secure conduits to backboard when entering room from overhead.
 - 3. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
 - 4. Provide ladder rack spanning length of equipment room, running down the center of room or mount 12" above top of equipment racks. Coordinate rack locations with Owner.
 - 5. Install J-Hooks around perimeter of room near top of backboards 12" O.C.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Install Cat 6 patch panel termination hardware unless otherwise indicated.
 4. MUTOA shall not be used as a cross-connect point.
 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least **49 feet** from communications equipment room.
 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 7. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches** and not more than **6 inches** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 12. In the communications equipment room and at workstation outlet in private offices, install a **10-foot-** long service loop on each end of cable. Locate private office service loop above accessible ceiling of office.
 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than **1/2 inch** from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of **8 inches** above ceilings by cable supports not more than **60 inches** apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Provide "J-hook" system throughout spaces with suspended acoustic ceiling system..
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **5 inches**.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **2-1/2 inches**.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of **48 inches**.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Locate grounding bus bar in data room to minimize the length of bonding conductors. Fasten to wall allowing at least **2-inch** clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
 1. Color-code cross-connect fields. Apply colors to data service connections, covers, and labels.

- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- E. Cable and Wire Identification:
 - 1. Label each cable within **4 inches** of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Exposed Cables: Label each cable at intervals not exceeding **15 feet**.
 - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 - 5. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6 and Category 5e marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
 - C. Prepare test and inspection reports.

END OF SECTION 26 7561

SECTION 28 1300 - ACCESS CONTROL AND SECURITY MANAGEMENT SOFTWARE

Note: All items in this section will be provided by the Owner and their security systems vendor. The GC will be required to coordinate with this contractor as the GC is still responsible to run all cabling and provide termination boxes and any required pathways.

Article I. PART I GENERAL

Section 1.01 GENERAL DESCRIPTION

- A The security management system (SMS) shall be a modular secure access management system used to better control employee and visitor movements at various establishments. The SMS shall be designed to maximize all tools offered by the Windows platform. All commands shall be accessible using nothing more than a mouse, and keyboard use shall be limited to documenting fields requiring numeric or alphanumeric data.
- B The operating program shall be multi-user and multi-tasking and capable of running on a non-proprietary CPU or virtual machines. The application software shall be based on a standard, high level programming language. The SMS shall be modular to facilitate its installation and the development of its capabilities while avoiding major modifications in its operation and in saving all defined system and historical data.
- C The server shall be a database server using a Sybase embedded SQL database. All database management tools shall be included, such as back-up, indexing, and database cleaning tools. No third party database tools or licensing shall be required. The multi-site gateway shall communicate system information between the server and controllers. The workstations shall be the primary user interface to perform supervisory and programming functions.
- D The SMS shall enable the selection of at least two user languages. The basic dictionary shall include English, French, Spanish, Italian, Portuguese, Simplified Chinese, Dutch, Turkish, and German, however, the system shall include a vocabulary editor to be used in designing custom language dictionaries. The operator's profile shall permit the selection of one of the two basic languages.
- E The SMS shall include RS-232 / RS-485 communication link between the various system components as well as TCP/IP network interface capability. Field devices such as card readers, alarm inputs, control points shall be connected to fully distributed intelligent field panels capable of operating without host computer intervention in a non-degraded mode.
- F The SMS shall be able to design customized ID cards directly from the access management software. No specific program or software other than the access management software and no additional licensing shall be required for this function. Any workstation shall be capable of being used as a badging station. Badging shall be fully integrated with the card database.

Section 1.02 SUBMITTALS

- A Shop Drawings - Prior to assembling or installing the SMS, the contractor shall provide complete shop drawings which include the following:

1. Architectural floor plans indicating all system device locations.
2. Full schematic wiring information for all devices. Wiring information shall include cable type, cable length, conductor routings, quantities, and point-to-point termination schedules.
3. Complete access control system one-line block diagram.
4. Statement of the system sequence of operation.
5. Riser diagrams showing interconnections.
6. Detail drawings showing installation and mounting.
7. Fabrication drawings for console arrangements and equipment layout.
8. Test and Commission site report.

B All drawings shall be fully dimensioned and prepared in DWG format using AutoCAD.

C Product Data - Prior to assembling or installing the SMS, the contractor shall provide the following:

1. Complete product data and technical specification data sheets that includes manufacturer's data for all material and equipment, including terminal devices, local processors, computer equipment, access cards, and any other equipment provided as part of the SMS.
2. A system description, including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment operates as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:
 - a) Central processor configuration and memory size.
 - b) Description of site equipment and its configuration.
 - c) Protocol description.
 - d) Hard disk system size and configuration.
 - e) Backup/archive system size and configuration.
 - f) Startup operations.
 - g) System expansion capability and method of implementation.
 - h) System power requirements and UPS sizing.
 - i) A description of the operating system and application software.

D As-Built Drawings - At the conclusion of the project, the Contractor shall provide "as built" drawings. The "as built" drawings shall be a continuation of the Contractors shop drawings as modified, augmented, and reviewed during the installation, check out and acceptance phases of the project. All drawings shall be fully dimensioned and prepared in DWG format using AutoCAD.

- E Manuals - At the conclusion of the project, the Contractor shall provide copies of the manuals as described herein. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each security system integrator installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. Date of project commencement, milestones, CCO's and completion to be included also. The manuals shall contain the following:
1. Functional Design Manual - shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. All operational changes required by customer are to be documented in writing where they differ from original Specification
 2. Hardware Manual - The hardware manual shall describe all equipment furnished including:
 - a) General description and specifications.
 - b) Installation and test and commission procedures.
 - c) Equipment layout and electrical schematics to the component level.
 - d) System layout drawings and schematics.
 - e) Alignment and calibration procedures.
 - f) Manufacturers repair parts list indicating sources of supply.
 - g) Load calculations of equipment operating at maximum load.
 3. Software Manual - The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a) Definition of terms and functions.
 - b) Use of system and applications software.
 - c) Initialization, startup, and shut down.
 - d) Alarm reports
 - e) Reports generation
 - f) Data base format and data entry requirements.
 - g) Directory of all disk files.
 4. Operators Manual - The operator's manual shall fully explain all procedures and instructions for the operation of the system including:

- a) Computers and peripherals
 - b) System startup and shut down procedures.
 - c) Use of system, command, and applications software.
 - d) Recovery and restart procedures.
 - e) Graphic alarm presentation
 - f) Use of report generator and generation of reports.
 - g) Data entry
 - h) Operator commands
 - i) Alarm messages and reprinting formats.
 - j) System access requirements
5. Maintenance Manual - The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components. Maintenance manual shall also include a list of recommended spares which are liable to be encountered as part of routine service procedures

Section 1.03 QUALITY ASSURANCE

- A Manufacturer Qualifications- The manufacturers of all hardware and software components employed in the SMS shall be established vendors to the access control/security monitoring industry for no less than five (5) years and shall have successfully implemented at least 5 systems of similar size and complexity.
- B Contractor/Integrator Qualifications
1. The security system integrator shall have been regularly engaged in the installation and maintenance of integrated access control systems and have a proven track record with similar systems of the same size, scope, and complexity.
 2. The security system integrator shall supply information attesting to the fact that their firm is an authorized Kantech Corporate Dealer.
 3. The security system integrator shall supply information attesting to the fact that their installation and service technicians are competent factory trained and certified personnel capable of maintaining the system and providing reasonable service time.
 4. The security system integrator shall provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.
 5. There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems.

C Testing Agencies

1. The following hardware have been tested and listed by Underwriters Laboratories (UL) for UL 294 for access control system units.
 - a) KT-300
 - b) KT-400
 - c) KT-1
 - d) IP link
 - e) P225W26
 - f) P225KPW26
 - g) P225XSF
 - h) P225KPXSF i. P325W26
 - i) P325KPW26
 - j) P325XSF
 - k) P325KPXSF
 - l) KT-MOD-REL8
 - m) KT-MOD-INP16
 - n) KT-MOD-OUT16
 - o) KT-3LED-Plate
 - p) KTES.
 - q) ioSmart Readers
 - i) KT-MUL-MT
 - ii) KT-MUL-SC
 - iii) KT-SG-MT
 - iv) KT-SG-SC
 - v) KT-SG-MT-KP
 - vi) KT-MUL-MT-KP
2. The hardware shall comply with the following regulatory requirements:
 - a) FCC Part 15 Class A.
 - b) FCC Part 15 Class B.
 - c) FCC Part 68 (TIA968).
 - d) ICES-003.
 - e) CE.
 - f) ECCN for AES 128 bit encryption for IP communication.
 - i) IP Link, KT-400 or KT-1 only.
 - g) Government standards NISPOM 5-313 Automated Access Control Systems, DICD Annex F 2.3 Accept/Reject Threshold Criteria, JAFAN Annex D 2.3 Accept/Reject Threshold Criteria.
 - h) The ioSmart readers shall have an IP 55 rating.

3. The SMS shall support Americans with Disabilities Act (ADA) compliance in door and access operation.

Section 1.04 WARRANTY - The security management system (SMS) shall be provided with a 12 month product warranty from date of registration. Software version updates shall be available for no charge during this warranty. The software media warranty shall be 90 days.

Article II. PART II PRODUCTS

Section 2.01 MANUFACTURERS

The security management system (SMS) shall be the Kantech EntraPass Corporate Edition.

Section 2.02 DESCRIPTION

The security management system (SMS) shall be an integrated system that utilizes a Sybase embedded SQL database for the storage and manipulation of related data. The SMS shall include a server with applications software, multi-site gateways for communication between the server and controllers, operator and administrator workstations with appropriate software, hard copy printers and secure backup media. The security field devices (readers, door position switches, REX) shall communicate with the field panels via a dedicated cable network. The field panels shall communicate to the server via a Fast Ethernet 10/100 TCP/IP network, RS-232/RS-485 connection, or dial-up modem.

The SMS shall allow for growth and scalability from a smaller system to a larger, high-end, or enterprise system. The SMS shall be modular in nature, allowing system capacities to be easily expanded without requiring major changes to system operation. All defined system data as well as historical information shall be maintained. Customizable user interfaces shall allow management of system information and activity for administrators and operators. The response time between the moment when a card is presented at the reader and when the door is unlocked shall not exceed one second. The SMS shall include a badging solution with a GUI for badge design. No extra licensing shall be required for the badging solution.

The SMS shall be able to connect to authenticated SSL cloud based or non-SSL or non-authenticated e-mail server for all e-mail features described. The SMS shall be able to connect to an SMTP or POP3 authenticated e-mail server.

The SMS shall support the following devices:

20	Workstations
50	Concurrent Web/mobile applications
20	Redundant servers
40	Digital video recorders per type
41	Multi-site gateways
2048	Connections per multi-site gateway (max: 10,000 doors)
10,000	Door controllers per multi-site gateway
10,000	Readers per multi-site gateway
100,000	Monitored points per multi-site gateway
100,000	Control relays per multi-site gateway
Unlimited	Access cards
Unlimited	Card families or site codes
2	Simultaneous operator languages

Section 2.03 PERFORMANCE - MONITORING

A Monitoring Mode

1. The SMS shall enable every operator to customize their desktop configuration. It shall be possible to modify the desktop appearance and to create up to eight desktops and to associate up to 10 different display screens to each. It shall be possible to modify the size and position of all screens. It shall be possible to determine if these screens shall be floating anywhere on the desktop or fixed on the desktop. If the workstation is equipped with a dual output video card and two or more monitors, it shall be possible to distribute the screen to multiple monitors. However, each screen shall be able to be viewed alone or together depending on operator needs. Once these parameters are saved, the configuration shall automatically take effect whenever the operator logs in.
For all types of screens, it shall be possible to access the general properties of the screen by simply right clicking at the center of the screen. From there it shall allow for linkage between associated screens without having to exit the current screen or section. It shall be possible to right click events on the desktop for editing which shall bring the user directly to the card, door, or component window and back.

2. Message Screen

All events that occur shall appear in real time. The text shall include at least the date, time, and a pertinent description of the event as well as its condition. The display of this screen shall be customizable and a different background and message color can be used for every type of event.

In addition the background color shall be chosen per operator. Events shall appear in their defined color or the operator shall have the option to choose a text color for the events.

All component modification events shall be tagged with an addition (+), modification (=) or deletion (-) tag.

Every in-coming event shall be documented by one or more icons representing video images, photos, access card, server, gateway, controller, card reader, and relay or supervision point. It shall be possible to classify the events on the screen by sequence, date and time, type of event, or type of message. In addition, a text filter shall be available to facilitate searching. It shall be possible to access the last up to 100,000 transactions from this window without the need to request a special report.

It shall be possible to see the origin of the event so that the operator shall be able to see the event's parent. For example door and access events shall show the location (site) of the event.

It shall be possible to right click on an event and perform edit or other functions linked to the event.

3. Cardholder and Operator Photo Screen

When a card is presented to a card reader, the software shall automatically display the photograph of the cardholder in this window. From this screen it shall be possible to select the cardholder's name, card number, event text, and comments as well as specify a door or group of doors for which the operator would like to display a photo. The SMS shall support the display of up to four pictures simultaneously. Furthermore the SMS shall allow that each picture box be assigned to a specific door for additional filtering. In addition the SMS shall support the ability to view the operator's picture when operators generate events.

4. Filtered Message Screen

This screen shall be a copy of the text messages screen except it shall be possible to select a specific message filter. The SMS shall include a choice of pre-configured filters and the ability to create customized filters. For every new filter it shall be possible to associate a name to it, select the type of event, select door, select workstation, select gateway, select supervision input, and select output.

5. Alarm Screen

Alarms that require an acknowledgement by an operator shall be displayed on this screen in text form only. The text shall include at least the date, time and description of the alarm, and its condition. It shall be possible to classify events on the screen by sequence, date and time, type of event, or type of message. A text filter shall be available in order to facilitate the search.

When the SMS pop-up is acknowledged by e-mail, the SMS shall display the operator's name based on the e-mail that acknowledged it.

If instructions about an alarm are envisaged, they shall automatically appear in a second window on the screen. If a graphic is associated with the alarm, it shall appear automatically on the screen defined to this effect. The icon associated to the control point shall be represented and show the actual state of the point.

The operator shall be able to access a log book in order to document the alarm that occurred. Once this information is recorded in the log it shall not be erasable or modifiable. Operators shall also be able to see previous comments or system logs added for this event.

Operators shall be able to run a report of the alarms from this window.

It shall be possible to associate video call-up with an alarm. When this occurs, the main screen shall become the video screen, not the alarm screen.

6. Video Screen (Video View)

When the SMS is integrated with American Dynamics, Intevo Advanced, Intevo Compact, Exacq or Panasonic DVR/NVR, it shall be possible to view the video images of cameras associated with them. The SMS shall enable the creation of an unlimited number of video views, each one associated with up to 16 different cameras or graphics. It shall be possible for the operator to see at a minimum 48 cameras simultaneously using three video views per screen. It shall be possible for an operator to edit or modify an existing view or create a new one directly from this screen. For each video view it shall be possible to select sequential, mosaic pattern, or preset viewing modes.

The SMS shall allow the operator to switch between pre-programmed video and dynamic view. The dynamic view shall allow the operator to select any camera and view it regardless of the need to create a new video view. The dynamic view shall support up to 16 cameras simultaneously.

It shall be possible for an operator to access all the commands of a motion PTZ camera to include rotate on its axis, adjust its focus, and have a larger view of the image. Accessibility to camera images and commands shall be limited by operator security level.

No additional licensing shall be required to perform this function.

The SMS shall allow the operator to select video views based on site linking. Site linking will allow SMS operators to navigate the SMS with ease by site or system wide.

7. Historical Message Screen

This screen shall allow operators to choose from a previously created custom report. Operators shall choose a start and end time, and a start and end date. The report will be populated in this window and have the same characteristics of the message screen including all right click functions.

The historical message screen shall allow operators to add comments to any event that can be later seen and reviewed.

B Graphics Screen

1. There are three options for graphics that appear as background on the screen. The first is a reproduction of the building(s) floor by floor. The graphic module shall be capable of importing files in BMP, EMF, WMF, JPEG, GIF, PCX, PNG, TIF, or PCD formats.
2. The second option is using web pages, or WebViews, as background on the screen. This can be used in the following manners:

- a) Accessing to DVR web servers.
 - b) Embedding default web pages into operator desktops.
 - c) Adding an IP camera onto a video view.
 - d) Embedding Intranet pages or directories into the operator environment.
 - e) Adding PDF, Word documents to the desktop.
 - f) HTML or PDF pop-up instruction on alarm.
 - g) Integrating report folders in the desktop for quick access.
3. The third option is to assign a live video view as background on the screen if video integration is being utilized.
 4. For all three options, control points shall be represented by a descriptive icon. Control points include workstations, gateways, controllers, card readers, doors equipped with either card readers or supervision contacts, cameras, relays, cameras, video views, task triggers and input monitoring points such as motion sensors. The icons shall be animated, meaning they shall represent the state of the point to which they are associated in real time. Every graphic shall support at least 100 control points.
 5. Right clicking on an icon shall directly access the manual commands of each control point. A door shall be capable of but not limited to temporarily unlocking, manually unlocking or locking, enabling or disabling a reader, viewing the reader's comments, and enabling or disabling the KT-400 or KT-1 door contact. A supervision point shall be capable of being enabled or disabled. A control relay shall be capable of being activated, deactivated, or temporarily activated. Cameras shall be capable of viewing images or live video.
 6. No additional licensing shall be required to perform this function.
 7. The SMS shall allow the operator to select graphics based on site linking. Site linking will allow SMS operators to navigate the SMS with ease by site or system wide.

C Communication Methods

1. The SMS shall ensure the communication to remote sites over a LAN or WAN/Internet using a dedicated communication server device, Kantech IP Link, KT-1 Controller or the KT-400 controller. This shall only be applicable with the use of multi-site gateways. It shall ensure secure communications by the use of 128-bit AES encryption. It shall reduce bandwidth consumption by managing the communication protocol of Kantech controllers at the remote site. Polling of Kantech controllers shall be done by the Kantech IP Link, KT-1 controller or KT-400 in the field and not over the network. The Kantech IP Link, KT-1 controller or KT-400 shall provide support for up to 32 door controllers. The Kantech IP Link or KT-400 shall be configured from the access software or from a web page which has the security feature of being disabled after successful use.

2. For connections that do not have network links, communication to remote sites shall be ensured by dial-up modems. This shall only be applicable with the use of multi-site gateways. The SMS shall support up to 32 such modems that can simultaneously transmit or receive data from remote connections. No modem shall be dedicated to a specific connection; communication shall be established where the first connection calling shall have access to the first available modem, and so on.
3. Each multi-site gateway shall be able to control 32 local controller loops by using the RS-232/RS-485 protocols via serial or USB port. In addition, each multi-site gateway shall be able to control up to 2048 (10,000 doors maximum Ethernet loops using TCP or UDP protocols, via the use of the Kantech IP Link, KT-1 controller or KT-400 of 32 controllers each.
4. The SMS shall differentiate between sites and connections. A connection shall be a hardware connection of controller over IP, direct, or dial up to the multi-site gateway. A site shall be a collection of any connection from any multi-site gateway.
 - a) Operators shall be able to add connections to sites as needed.
 - b) Operators shall assign access levels to cardholders via the site. Having to assign an access level to every connection shall be unacceptable as this is time consuming.
 - c) Operators shall be able to view, lock and unlock all doors belonging to a site regardless of their connection.
 - i) Operators shall have the option to expand the site and see which connection the doors belong to.
 - d) When programming access levels, operators shall see all doors belonging to one site. From there the operator shall be able to assign a schedule to a door for the user's access.
 - e) Operators shall be able to take existing connections that are not part of any site and merge them into existing sites.
 - i) The SMS shall give them an option to merge identical schedules in order to remove duplication and unwanted schedules.
 - ii) The SMS shall give the option to enter a duplicate name as a prefix.
 - iii) The SMS shall give the ability to rename the connection's access levels names.
 - iv) The ability to reprogram access levels and other items shall not be available.
5. Each site and connection shall have the ability to have 20 user definable fields. The field label names shall be changeable.
 - a) Operators shall be able to enter up to 40 characters per field.
6. In all communication methods, the door controller shall retain in their memory all necessary data for controlling doors that they supervise. In case of communication failure, the door controller shall execute all its functions normally.

7. When using a KT-1 it shall be possible to use the auto-enrollment functionality. An operator shall be able to press a button on the KT-1 controller which shall find the EntraPass multi-site gateway. Once found by the SMS, the operator shall quickly and efficiently be able to enroll the KT-1.
 - a) The auto-enrollment shall work on a local LAN segment of the network.
 - b) The SMS shall display a dedicated list of all unassigned KT-1s. From the EntraPass workstation or Web. The operator shall simply pick the KT-1 they are interested in.
 - c) The SMS shall allow the following functionality using the auto-enrollment wizard:
 - i) Assign a KT-1 to a site/connection.
 - ii) Name the door
 - iii) Activate the exit reader.
 - iv) Activate the door contact.
 - v) Activate the request to exit.
 - d) The SMS shall auto-fill the MAC address and Serial number. Having to manually enter the MAC address or serial number in the auto-enrollment shall not be acceptable.

Section 2.04 PERFORMANCE – PROGRAMMING & CONFIGURATION

A User Section

1. This section shall include all functions involved in the issuance of an access or ID card as well as database search and importation tools. During the addition or modification of a card, information about the card shall be sent to the door controllers affected by these new parameters as soon as the operator accepts the addition or modification. An additional command requiring a reloading of the cards database in the door controllers shall not be acceptable.
2. The SMS shall allow adding door access exceptions to the cardholder's list of access rights.
 - a) The SMS operator shall be able to provide a pre-defined access level and separately add a specific door to be part of the cardholder's access rights.
 - b) The door shall have its own schedule.
 - c) The SMS operator shall have the option of allowing or disallowing access to that door based on that schedule.
 - d) There shall be no limit to the number of doors that can have exceptions.
 - e) The KT-400 and KT-1 shall keep in memory the door access exceptions even in standalone mode. This feature shall be available with the KT-400 and KT-1.
3. The SMS shall enable the creation and definition of a user access card. There can be up to five cards per user, and users can be managed by cardholder name or card number. When creating user cards, the operator shall be able to select a card format directly from a Card dialog and enter the card number as it is printed on the card.

4. The following user information shall be able to be saved in the user section:
 - a) Five card numbers each with their own expiration date, trace and lost or stolen statuses.
 - b) Each card numbers shall have their own expiration date and expiration hour.
 - i) The card numbers shall have the option to be mandatory or not mandatory.
 - c) First and last name.
 - d) Card type.
 - e) Additional information (10 fields).
 - f) Start date
 - g) Expiry date
 - h) Personal ID number (PIN).
 - i) State of the card
 - j) Multi-swipe activation
 - k) Comments
 - l) User's e-mail address
 - m) GoPass configuration:
 - i) Notification
 - ii) Language
 - n) HID Mobile Credentials Management.

In addition, it shall be possible to associate a photograph, signature, and badge template to a card. The picture of the cardholder shall always be visible when the profile is active on the screen.

5. The SMS shall allow for the creation of an unlimited number of card templates to be used as ID cards. Template parameters include name, number of sides, and size. It shall be possible to directly print a template on an access card. The operator shall be able to design customized badging templates directly from the access management software. No specific badging program or software other than the latter and no additional licensing shall be required for this function. Any workstation shall be capable of creating ID cards based on operator security level. The following items shall be capable of being added to and modified on a badge template:

- a) All information fields associated to a cardholder.
 - b) Bar code
 - c) Text zone
 - d) Start date, expiry date, today's date.
 - e) Saved images and logos
 - f) Borders
 - g) Rectangles (including rounded rectangles, ellipse).
 - h) Lines and arrows
 - i) Photograph (can be cropped)
 - j) A background
6. The SMS shall allow for the creation of a day pass to be issued to visitors for a single day. The SMS shall also have the ability to create temporary ID visitor cards.
7. The SMS shall offer the possibility of modifying the parameters of a group of cards simultaneously based on Card Type. The system shall enable the creation of an unlimited number of card types. The following fields shall be modifiable:
 - a) Card status (valid, invalid, lost, stolen).
 - b) Card monitored (yes, no).
 - c) Start date (schedule).
 - d) End date (schedule).
 - e) Delete after expiration (yes, no).
 - f) Wait on keypad (yes, no).
 - g) Access group (selection menu).
 - h) Template model (selection menu).
8. The operator shall be able to search for a card by last or first name, card creation date, card number, or any of the ten fields of user definable information. The system shall display the last card transactions, namely the latest sixteen denied access events, authorized events, database events, and/or time & attendance events.
9. The operator shall be able to quickly search by username directly on the card window. The SMS shall automatically provide the 24 first search results by simply typing the value and then expanding the dropdown list.
10. The operator shall be able to quickly view the cardholder's door list.
 - a) Operators shall be able to export the door access list.
 - b) A detailed view of the door's schedule shall be show when selecting a door.
11. The operator shall have the option of expanding the comments field in the user section for better viewing.

12. The SMS shall enable the creation of an unlimited number of import/export models, give them a name, select required fields, select their layout, and determine the field delimiter. This shall allow for acceleration of the data entry process by importing databases from a spreadsheet.
 - a) The SMS shall allow operators to quickly add a door to a list of access levels.
 - i) The SMS operator shall select a door and see a list of access levels.
 - ii) The SMS shall return to the access level assigned to the door shown on the schedule. If the door is not assigned to an access level, it shall show none.
 - iii) The SMS operator shall be able to change any of the doors assigned access levels by simply changing the schedule.
13. The SMS shall allow for 250 access levels programmed per loop/site of controllers. Every card shall be assigned an access level, which shall determine where and when the access card will be valid. When the system consists of several sites or gateways, it shall be possible to use batch programming of access levels.
14. The SMS shall support up to a total of five access levels for each card user per site/connection when using the multi-site gateway. This feature shall be available with the KT-400 and KT-1. The SMS shall advise the operator if doors are not supported when adding additional access levels (two to five).
15. The SMS shall allow for creation of tenant lists that can be imported in the (Kantech Telephone Entry System) KTES units. The lists shall be easy to fill up and allow for up to 3000 tenants in each list. The SMS shall support the creation of unlimited amounts of tenant lists.
16. The SMS shall allow of importing and exporting of tenant lists. The operator shall have the ability to choose which fields to import and export.

17. The following tenant information shall be able to be saved for each tenant:
 - a) Tenant name
 - b) Tenant ID (customizable in length per tenant list).
 - c) Primary telephone number.
 - d) Secondary telephone number
 - e) Tenant PIN (customizable in length per tenant list).
 - f) Pin access schedule
 - g) Tenant level
 - h) Tenant language
 - i) Card number
 - j) Disable card trace
 - k) Start/end date
 - l) No disturb schedule
 - m) Prioritized tenant in the display list.
 - n) Call second phone number, option schedule.
 - i) Ability to call the second phone number only (does not call primary) during valid schedule.
18. The SMS shall allow for a card number to be assigned to a specific tenant. The KTES unit will be able to send the card number to other controllers of a Wiegand protocol.
19. The SMS shall allow for an unlimited amount of card types. Cards types shall be used to group cards together for ease of management. Card types shall have the option of being assigned a card access group template. Card access groups shall be copied to the cardholder's profile to give the cardholder's access levels.
20. The SMS shall provide the possibility to perform card batch operations. The mass card modifications shall take effect in real time. Each batch operation shall allow for a batch of cards to be changed based on their card type. The batch card modification shall be able to change the following :

- a) Card state
- b) Supervisor level
- c) Card count value
- d) Card tracing
- e) Start date
- f) End date
- g) With deletion on expiration.
- h) Waiting for keypad
- i) Card access group
- j) Replacing access levels
- k) Updating access levels
- l) Adding new access levels.
- m) Updating and adding new access levels.
- n) Card badge layout

B Video Section

1. The SMS shall be capable of being combined with up to 40 DVRs per type, such as American Dynamics Intellex digital video recorders, American Dynamics Hybrid DVR (HDVR), American Dynamics TVR2, American Dynamics VideoEdge, American Dynamics VideoEdge Hybrid NVR v4.03, Intevo Advanced, Intevo Compact, exacqVision A-Series, exacqVision Z-Series, exacqVision EL-Series (EL-S, ELX-S, ELX-IP, ELX-SR), exacqVision LC-Series (LC, LC-IP), IP DVR/NVR products without any additional licensing.
 - a) The SMS shall allow the operator link video servers and cameras to a site. Site linking will allow SMS operators to navigate the SMS with ease by site or system wide.
2. The SMS shall be combinable with up to 40 Panasonic DVR/NVRs with a valid option code. The SMS shall support the following Panasonic DVR/NVRs:
 - a) WJ-ND400
 - b) WJ-ND200
 - c) WJ-ND300A
 - d) WJ-HD220
 - e) WJ-HD309A
 - f) WJ-HD316A
 - g) WJ-HD616/WJ-HD716
 - h) WJ NV200
3. From any of the workstations it shall be possible to do the following:

- a) View one or more camera images from different sources.
 - b) Query the history of each recorder and view images saved on disk.
 - c) View, modify, or delete programming parameters of a recorder.
 - d) Control the movement of all motion cameras directly with the workstation mouse of the SMS (PTZ control).
 - e) Export camera images to hard disk and video vault (capable of exporting multiple formats, password protected to protect chain of evidence).
4. The SMS shall ensure the time management and synchronization for all the American Dynamics DVR/NVR. It shall be possible to determine the time refresh frequency on the network for the American Dynamics DVR/NVR. The SMS shall allow for configuration of each DVR/NVR. For each recorder it shall be possible to:
 - a) Assign a name
 - b) Determine the recorder type.
 - c) Determine the network IP address or domain name (DNS).
 - d) Manually configure the video, communication and event ports.
 - e) Determine the number of cameras.
 - f) Determine the query frequency.
 - g) Determine the number of failed queries required before a loss of communication message is displayed on the screen.
 - h) Import camera details from existing video servers.
5. The SMS shall define the programming parameters for every camera connected to a DVR/NVR. For each camera it shall be possible to:
 - a) Assign a name
 - b) Determine the type of camera.
 - c) Assign a representative icon for identification on a graphic screen.
 - d) Determine if the camera image can be visible on a video view.
 - e) Determine the type of recording.
 - f) Determine which events from the recorder shall display an alarm message on the screen.
 - g) Determine the number of pre-selections desired.
 - h) Determine the number of patterns desired.
 - i) Add comments to record in the video vault.
6. The SMS shall allow for the creation of an unlimited number of video views. For each video view it shall be possible to connect up to 16 cameras from various sources.

7. The SMS shall be able to incorporate on the same view on multiple cameras from different American Dynamics Intellex DVRs or graphics. Furthermore on different video views the SMS shall be able to incorporate multiple camera sources from different American Dynamics HDVRs, Intevo Advanced, Intevo Compact, exacq or graphics. In addition, on different video views the SMS shall be able to incorporate multiple cameras source from different American Dynamics TVR2 or graphics. In addition on different video views the SMS shall be able to incorporate multiple cameras source from different American Dynamics Video Edge NVRs or graphics. Also, on different video views shall the SMS shall be able to incorporate multiple camera sources from different Panasonic DVR/NVR of the same model or graphics.
8. The video view programming parameters make it possible to complete the following:
 - a) Assign a name
 - b) Determine the view size.
 - c) Determine the refresh rate of the image.
 - d) Determine whether to show metrics.
 - e) Determine whether to show camera controls.
 - f) Determine whether to show overlays.
 - g) Determine whether to auto-hide text.
 - h) Determine whether to activate image zoom.
 - i) Determine whether to activate video sequence.
 - j) Determine delay before sequence launch.
 - k) Determine camera display delay.
 - l) Determine display pre-selection delay.
 - m) Determine pattern display delay.
 - n) Determine graphic display delay.
 - o) Determine display mode (1 x 1, 2 x 2, 3 x 3 and 4 x 4).
 - p) Incorporate up to 16 cameras from various sources or 16 graphics.
9. The SMS shall be able to trigger, from one or more specific events, the start of a recording on a recorder with one or more cameras connected to it. The SMS shall allow for the creation of an unlimited number of video triggers. The SMS shall allow for the creation of an unlimited number of recording parameters. For each recording parameter it shall be possible to:

- a) Define a name
 - b) Select the DVR/NVR to which this recording parameter refers.
 - c) Select the camera to which this recording parameter refers.
 - d) Associate a pre-selection or size.
 - e) Determine the start recording trigger.
 - f) Determine the pre-alarm time.
 - g) Determine the total recording time.
 - h) Determine the stop recording trigger.
10. It shall be possible for a video event on one DVR/NVR to trigger an action on another DVR/NVR.
 11. The SMS shall allow the playback of all recordings stored on the hard drive of any of the DVR/NVR. The operator shall be able to save the video into the video vault.
 12. The SMS shall provide the operator access to the complete list of normal and abnormal events that required the activation of video recording. The sequence of images can be saved to a hard drive for subsequent consultation and shall be encrypted. The SMS shall allow the operator to access a complete list of alarm recordings in progress including origin of the alarm. The SMS shall be capable of displaying a list of exported videos.
 13. It shall be possible to view recorded video tagged to an access or video event by quick linking from the message desktop.
 14. The SMS shall be capable of connecting 40 DVRs per type, such as American Dynamics, Intevo Advanced, Intevo Compact, exacqVision A-Series, exacqVision Z-series, exacqVision EL series (EL-S, ELX-S, ELX-IP, ELX-SR) and the exacqVision LC-Series (LC, LC-IP), IP DVR/NVR products with no additional options needed.

C Definition Section

1. The SMS shall allow the creation of 100 schedules per connection/site of controllers and an unlimited number of system schedules. Each schedule can include up to 20 intervals. By default each schedule shall support four intervals. A schedule can be associated with a supervision point, a relay, an access level, a door, elevator floor, an operator, or an event. The SMS shall allow time zone management.
2. With a multi-site gateway, specific schedules, which include up to 20 intervals shall be available for the KT-400 and KT-1. The KT-400 and KT-1 shall keep all 20 intervals in memory when in stand-alone mode.

3. The SMS shall allow the creation of 366 holidays. It shall be possible to define a name, define a date, and determine the type. The SMS shall allow the operator to view all the holidays defined in holiday type and sites by viewing them all in a yearly calendar.
 - a) The SMS shall not require a same date to be created multiple times when affecting certain sites. The SMS shall allow for the same holiday date to be used on certain sites or on the entire system.
4. The SMS graphics shall enable operators to view the exact location of a component installed at the site, or the state of components and peripherals represented in the graphic such as doors, contacts, motion sensors, controllers, video views and cameras. The SMS shall allow for the creation of an unlimited number of graphics. The components on the graphics represented by icons as well as the graphics themselves shall have the ability to be modified. The SMS shall allow for printing of the graphics with their respective components on the graphical floor plan.
5. The SMS shall allow the management of 2,048 elevator cabs of 64 floors each for each gateway. It shall be possible to associate a schedule to the call button. Outside of the schedule, a valid card for a particular floor will have to be presented to the cab reader for it to be activated. The floor selection button group associated with the card's access level will become operational for a predefined duration and all other buttons shall become inactive. The SMS shall allow the creation of groups of floors and access levels.
6. When using KT-400 controllers, each elevator floor shall have the ability to associate to its own unlock schedule. Thus, every elevator floor shall be available without a card read at its respective time.
7. The SMS shall provide the possibility to setup unlimited amount of tasks via the user-friendly task builder. The operator shall be able to create e-mail templates that can incorporate a variable to dynamically populate the e-mails. Using the command GUI menu, the operator can program commands for any component in the SMS. Commands such as but not limited to lock, unlock, temporary unlock, toggle, back to schedule for the doors, relays, inputs and enable and disable readers. The operator can also program commands for specific card count. The commands shall be able to accept specific components or variables that can filled dynamically.
8. The SMS shall provide the possibility to setup unlimited batch card operations via the user-friendly task builder. The batch card modifications shall take effect in real time. Each batch card modifications task shall allow for cards to be changed based on their card type. The batch card modification task shall be able to change:

- a) Card state
 - b) Supervisor level
 - c) Card count value
 - d) Card tracing
 - e) Start date
 - f) End date
 - i) With deletion on expiration
 - g) Waiting for keypad
 - h) Card access group
 - i) Replacing access levels
 - ii) Updating access levels
 - iii) Adding new access levels
 - iv) Updating and adding new access levels.
 - i) Card badge layout.
9. The SMS shall provide the possibility to assign the tasks previously created to be triggered on specific components and specific events.
10. The SmartLink task commander shall process the command from the first available SmartLink application on the SMS.
- a) The use of a specific SmartLink to run the SmartLink task commander shall not be accepted. The SMS shall accept multiple SmartLink to be installed thus providing a redundant SmartLink for all SmartLink task commander tasks.
11. The SMS shall allow for the creation of unlimited instructions. These instructions shall be attributed to one or more events that will be used in documenting the event and guide the operator on duty in performing tasks. It shall be possible to edit the instructions in two different languages.
12. The SMS event trigger shall also serve alarm acknowledgement (pop-ups) configuration. Pop-ups shall be configured to alert SMS operators in real time of specific events on specific components.

13. The SMS shall allow how pop-up's occur by allowing the SMS operator to configure a component (or components) and specific event (or events) are sent to the SMS workstations and/or e-mail.
 - a) For each pop up the SMS operator shall be able to choose the following features but will not be limited to them:
 - i) Event (or events)
 - ii) Component (or components)
 - iii) Workstation (or workstations) receptions
 - iv) Instructions
 - v) Schedule the pop-ups occurs.
 - vi) Instructions
 - vii) Mandatory operator comments.
 - viii) E-mail notification
 - ix) Able to acknowledge by e-mail.
14. When the alarm pop-up occurs in real time, the SMS pop-up shall display the following but will not be limited to them:
 - a) Date/time
 - b) Event
 - c) Component name
 - d) Instructions
 - e) Video playback of associated camera and video clip created.
 - f) Automatically opens live video of associated camera.
 - g) Able to acknowledge or temporary suspend an alarm.
 - h) Audible sound playing wave file to audibly alert SMS operator.
15. When the alarm pop-up occurs in real time, the SMS pop-up if configured accordingly will send an e-mail with the following items but will not be limited to the following:
 - a) Date/time
 - b) Event
 - c) Component name
 - d) Instructions
 - e) Event assigned color
 - f) Able to acknowledge alarm
16. The SMS shall support up to 999 action schedulers. These action schedulers shall allow the user to perform actions on the KT-400 and KT-1 on a pre-defined timeframe.
 - a) Each action scheduler shall allow up to eight different components to be triggered. These components can be from the same controller or a different controller.
 - i) The action scheduler shall be stored in the KT-400 and KT-1. Once programmed by the SMS, the controller shall not need the SMS to trigger the action scheduled.

- b) The action scheduler shall allow but will not be limited to the following:
 - i) Toggle door unlock.
 - ii) Unlock door.
 - iii) Relock door.
 - iv) Temporarily unlock door.
 - v) Activate Relay.
 - vi) Deactivate Relay
 - vii) Temporarily activate relay.
 - viii) Arm door partition
- c) The action scheduler shall be scheduled to trigger at limited intervals but will not be limited to these intervals:
 - i) Once on a specific date and time
 - ii) Daily at a specific time until a specific date
 - iii) Weekly at a specific time until a specific date
- d) The SMS shall also allow the SMS to trigger a task (task builder) within the action scheduler.
 - i) These tasks shall be SMS dependent but can trigger anything configurable in the SMS tasks.
- e) The SMS shall offer overview windows where SMS operators can easily see the upcoming action schedulers.
 - i) The SMS operator shall be able to see the upcoming action schedulers in the following views:
 - 1) Daily
 - 2) Weekly
 - 3) Monthly
 - 4) Yearly
 - 5) “Bring me to the next action” button shall bring the SMS operator to the next action scheduled.
 - ii) The SMS operator shall be able to see if the action scheduler is a one-time action or a reoccurring action without having to open the action scheduler.
- f) The SMS operator shall be able to add keywords in the action scheduler during programming. This will allow the SMS operator to quickly search for the actions using the action scheduler name or keywords programmed.
- g) The SMS shall give the option to delete the action scheduler once it is completed.

D Devices Section

1. The physical components of the SMS including workstations, multi-site gateways, gateway, site, controllers, Kantech Telephone Entry System (KTES), doors, relays, ioSmart Readers, ioSmart reader templates, and monitored inputs shall be individually configured and defined. Individual sites shall also be defined. The software shall allow the use of a controller express setup feature in order to minimize the time needed for controller definition.
2. Each component in the devices section shall allow for a comment section per component. The SMS shall allow for unlimited amount of characters in the comment section.
3. The SMS shall allow to migrate from the SMS legacy controllers to KT-400 and KT-1 without having to reprogram the controllers, access levels, doors and their respective associations.
 - a) The SMS controller in the database shall only take a second.
 - b) The SMS shall not in the background erase or reprogram the controller. By migrating and not erasing/reprogramming, the SMS will allow any custom integration and SMS associations to continue to work as the controllers are the same.
 - c) The SMS shall allow to migrate from a KT-100, KT-200, KT-300, KT-1 to a KT-400.
 - d) The SMS shall allow to migrate from a KT-100 to a KT-1.
 - e) The SMS expansion modules shall be reprogrammed manually.
 - f) The following values at the minimum shall remain the same after the migration:
 - i) Reader and keypad types
 - ii) Anti-passback settings
 - iii) Input EOL (end of line) resistor settings.
 - iv) Door name
 - v) Unlock times
 - vi) Door unlock schedules
 - vii) Door contact settings
 - viii) Rex contact settings
 - ix) Intrusion integration settings
 - x) Access level programming
 - xi) Reporting filters
 - xii) Workspace division settings
4. The SMS shall support the programming of the ioSmart readers with the KT-400 and KT-1 controllers over 128-bit AES encrypted RS-485 communication.

- a) The SMS shall offer an reader template where the SMS operators can customize the ioSmart behavior of the following items but not limited to:
 - i) HID Prox 125 khz support.
 - ii) ioSmart native support
 - iii) Mifare Plus, Mifare classic card serial number support.
 - iv) ISO 14443b card serial number support.
 - v) Keypad illumination intensity:
 - 1) Keypad always on
 - 2) Keypad dim
 - 3) Keypad off but wake up on touch
 - vi) LED color management for the following but not limited:
 - 1) Tamper in alarm
 - 2) Standby
 - 3) Key press
 - 4) Communication failure alarm
 - 5) Low power
 - 6) Lock power trouble
 - 7) Access result, can have different LED patters of the same color for the following results such as a but not limited to:
 - a. Access Granted
 - b. Access Denied—Bad access level
 - c. Access Denied—Card expired
 - d. Access Denied—Lost or stolen
 - e. Access Denied—Card unknown
 - f. Door armed/disarmed
 - g. Wait for keypad
 - h. Valid floor selection (when doing elevators).
 - i. Invalid floor selection (when doing elevators).
 - j. Request to exit
 - k. Time out on request to exit.
 - l. Time out on access granted.
 - m. Door open to long
 - n. Pre-alarm door open too long.
 - o. Wait for second card
 - p. Multi-swipe denied
- b) The SMS shall offer a default reader template and allow for custom reader templates to be created by the SMS operators.

- c) The reader templates shall be configured once and be available for all controllers.
 - i) Changing the reader template shall automatically change the configuration to all the controllers.
 - d) The SMS operator shall be able to:
 - i) Assigning a ioSmart reader via serial number to a controller door.
 - ii) Configuring input and outputs settings on ioSmart readers.
 - iii) Configuring keypad settings
 - e) From the SMS operations screen, the SMS operator shall be able to request the non-programmed ioSmart Serial number and the SMS operator shall automatically assign them to the doors.
 - f) From the SMS operation screen, the SMS operator shall be able to perform firmware updates on the ioSmart readers.
 - i) During the firmware updates the ioSmart shall continue to work.
 - g) From the SMS operation screen, the SMS operator shall be able to see the ioSmart Reader status such as but not limited to :
 - i) Firmware
 - ii) Tamper state
 - iii) Memory availability
 - h) The Legacy KT-200 and KT-300 shall also support the ioSmart over standard Wiegand protocol using dedicated cables for LED and BUZ.
5. The SMS shall allow to import KT-400 Standalone and KT-1 Standalone backup into the SMS as a new connection.
- a) The SMS shall allow to import the following but will not be limited to:
 - i) Controller name, programming, networking and MAC settings.
 - ii) Door names and programming.
 - iii) Schedule names and programming.
 - iv) Holiday names and programming.
 - v) Action scheduler name and programming.
 - vi) Cardholder lists and programming.
 - vii) Cardholder door access rights shall also be imported as door exceptions.

E Alarm Interface

1. The SMS shall interface with any external alarm system thereby arming or disarming the system by presenting a valid card to an entry/exit door. It also shall be possible to associate a keypad with a reader forcing the cardholder to enter a number in the keypad after presenting a card. This integration shall only be possible with the use of a multi-site gateway. It shall be possible at a minimum to complete the following:
 - a) Set a monitored input as an arming button.
 - b) Associate a usage schedule with an arming button.
 - c) Set the exit and entry delay.
 - d) Determine whether the system must wait for a valid access to arm.
 - e) Determine whether the system must wait for a valid access card swipe and appropriate pin number to disarm. Determine whether the door must relock on arming request.
 - f) Associate a monitored input with an alarm panel condition.
 - g) Lock a door unlocked by a schedule when armed.

F Integrations

1. LDAP- Operator Synchronization (Active Directory)

The SMS shall interface with the Active Directory (LDAP) for operator management. The SMS shall receive operators from the LDAP system these operators shall be modified and deleted as required.

 - a) The SMS shall sync from the Active Directory (LDAP) on a configurable time. Operator changes will flow from LDAP into the SMS. The SMS shall allow operators force a sync manually instead of waiting for the next sync cycle.
 - b) The LDAP shall be the authority manager for all operators synced with the SMS.
 - c) The SMS shall allow the creation of SMS operators that shall not be synced with LDAP.

- d) The SMS shall be able to sync but not limited to following LDAP fields:
 - i) Display name
 - ii) User principal name
 - iii) User account control (active or inactive).
 - iv) Password last set
 - v) Bad password time
 - vi) Bad password count
 - vii) Maximum passwords before change.
 - viii) Account expiration date
 - ix) Picture
 - x) E-mail
 - e) The SMS shall allow for as many security level/workstation configurations as needed. The Active Directory shall send down via profiles the proper rights.
 - f) The SMS shall give the option for operators to log into the SMS manually if Active Directory credentials don't match.
 - g) Certain operators shall be separate from the LDAP sync and shall be managed manually.
 - h) The SMS shall manage the LDAP integration from the SMS SmartLink and will require a license per LDAP.
 - i) The SMS shall support up to 10 different LDAP connections.
2. Single Sign On (SSO)
- a) The SMS shall allow the SMS workstation to offer single sign on when using the LDAP integration.
 - b) Operators shall simply need to login to Windows using their Windows domain login and open the workstation.
 - c) The SMS shall also allow a manual login to the client software.
 - d) The need to enter a username and password is not required with single sign on.
3. LDAP – Cardholder Synchronization
- The SMS shall interface with the Active Directory (LDAP) for cardholder management. The SMS shall receive LDAP users from the LDAP system, these users shall be modified and deleted as required.
- a) The SMS shall sync from the Active Directory (LDAP) on a configurable time. Cardholder changes will flow from LDAP into the SMS. The SMS shall allow SMS operators to force a sync manually instead of waiting for the next sync cycle.
 - b) The LDAP shall be the authority manager for all operators synced with the SMS.
 - c) The SMS shall allow the creation of SMS cardholders that shall not be synced with LDAP.

- d) The SMS administrator shall be able to pair the SMS field below to the LDAP Attributes. SMS values such as but not limited to the following):
 - i) Display name
 - ii) E-mail
 - iii) Card state
 - 1) The Card state shall be automatically linked to the LDAP “User is Disabled” value and disable/enable the SMS cardholder accordingly.
 - 2) The SMS administrator shall be able to overwrite the default assignment and provide a custom LDAP numerical attribute instead. This configuration shall ignore the LDAP “User is Disabled” value.
 - iv) Card numbers one to five
 - v) Card number’s variables such as expiration date and hour.
 - vi) Card type
 - vii) Access levels via the card access groups.
 - viii) Start/end date
 - ix) Picture
 - x) E-mail
 - xi) User definable fields one to 40.
 - e) When an SMS field is paired with an LDAP attribute, this such field shall be modifiable only from the LDAP. All other SMS fields shall be modifiable from the SMS client.
 - f) The SMS shall be allowed to pair any or all fields with the LDAP Attributes.
 - g) Certain SMS cardholders shall be separate from the LDAP sync and shall be managed manually.
 - h) The SMS shall manage the LDAP integration from the SMS SmartLink and require a license per LDAP.
 - i) The SMS shall import as SMS Cardholders the LDAP users that are part of a LDAP group and its children groups.
 - i) The SMS shall support up to 10 different LDAP connections.
4. Intrusion
- a) The SMS shall allow interface with the DSC PowerSeries PC1616, PC1832, PC1864, the MaxSys 4020 and the DSC PowerSeries Neo HS2016, HS2032, HS2064, HS2128 intrusion alarm panels. This interface eliminates the requirement for hardwire integration between the SMS controllers and the DSC PowerSeries® intrusion panel.

- b) The DSC PowerSeries Neo intrusion panels shall communicate with the multi-site gateway using RS-232 or TCP-IP/UDP-IP connection or with the Global Gateway/KT-NCC or directly to a KT-400/KT-1-PCB controller. Only one of these connections is possible at any time.
 - i) The SMS shall allow for virtual zones integration with the DSC Neo.
 - ii) The SMS shall trigger the DSC zone status based on the access controller event without the need for hardwiring relays or inputs. Zone statuses include alarm, in trouble or tamper.
 - 1) The SMS has the capacity to assign up to 32 virtual zones.
 - 2) The SMS shall have the capacity to assign up to 32 access controllers from the same multi-site gateway/Global Gateway to one Neo (for a virtual zone).
 - 3) The 32 controllers shall be from any type (KT-300, KT-400, KT-1). The main controller communicating with the Neo shall be either a KT-400 or KT-1.
 - 4) The SMS shall be able to assign one door to one virtual zone.
 - 5) The SMS shall be able to assign one input (access control) to one virtual zone.
 - 6) The SMS shall be able to assign access control events to one virtual zone, including but not limited to:
 - a. Access denied - Card expired
 - b. Access denied - Card lost or stolen
 - c. Access denied - Bad access level
 - d. Controller tamper
 - e. Controller AC failure
 - f. Controller low battery
 - g. Door forced open
 - h. Door open too long.
 - i. Input in alarm
- c) The DSC PowerSeries® and MaxSys series intrusion panels shall communicate with the multi-site gateway using RS-232 connection or with the Global Gateway/KT-NCC using RS-232 or directly to a KT-400/KT-1-PCB controller.
- d) The SMS shall allow the DSC Maxsys, PowerSeries and PowerSeries Neo to perform the following functions:

- i) Single and multiple partitions arming and disarming using a reader.
 - ii) Disarm using a card only or forced valid card and pin.
 - iii) Single and multiple partitions arming and disarming using operator commands.
 - iv) Receive events from intrusion panel.
 - v) Receive partition names, user codes and zone names programming.
 - vi) Update user codes.
 - vii) Assign user codes to cardholders.
 - viii) View a fully functional virtual keypad to perform all functions available on the DSC PowerSeries® 1616, 1832, 1864 or the MaxSys 4020 intrusion panel keypad.
 - ix) Control the PGM outputs from a graphic screen with the MaxSys 4020 integration.
 - x) Bypass zones with the Maxsys 4020 and NEO integration.
5. Simplex fire event viewing
- a) The SMS shall allow an interface with the Simplex 4100ES fire panel thereby eliminating hardwired integration between the SMS controllers and the Simplex 4100ES fire panel. The Simplex 4100ES fire panel shall communicate with the multi-site gateway using a RS-232 connection or with the Global Gateway/KT- NCC using RS-232 or directly to a KT-400/KT-1PCB controller. The SMS shall allow for:
 - i) View the events coming from the Simplex 4100ES fire panel.
 - ii) The events shall be able to be used for but not limited to: reporting, video triggers, and e-mail notifications.
 - iii) View the virtual keypad.

G System Section

1. The SMS shall define the profile of a system operator based on name, password, language, privileges, login schedule, security level, workspaces, and password expiry date. The SMS shall provide the possibility to force the operators to assign a mandatory card type to the users. The operator shall be able to provide a default card type for every card.
 - a) The SMS shall allow to send a welcome e-mail to the SMS operator.
 - i) The SMS shall allow the SMS operator to re-send the welcome e- mail as needed.
 - ii) This welcome e-mail shall include links to automatically pair the SMS operator with the following SMS applications:
 - 1) Link to download the EntraPass Web.
 - 2) Link to download and pair the SMS operator automatically to EntraPass Go for Apple® and Android® devices.
 - 3) Link to download and pair the SMS operator automatically to EntraPass Go Install for Apple® and Android® devices.

2. The SMS shall allow configuration of their Web/mobile rights to each operator:
 - a) Allow to login to Web/mobile.
 - b) Default message list filter.
 - c) Default message filter buffer upon login.
 - d) Concurrent login option.
 - e) Session timeout on idle timer.
3. The SMS shall offer the option for the SMS administrators to force strong passwords for operators. The strong password settings shall be configurable by the SMS administrators.
4. The SMS shall determine access rights granted to an operator based on security levels. There shall be three predefined access levels called installer, administrator, and guard. The SMS shall have the ability to create an unlimited number of security levels that can be assigned to one or more operators. It shall be possible to determine from which system components the operator shall be authorized to receive events and take action. It shall be possible to specify for each programming window if the operator can (any combination):
 - a) View the component in read only.
 - b) Add new components
 - c) Modify existing components (cannot add new).
 - d) Delete components
 - e) Save as
 - f) Print components
 - g) View links
5. The SMS shall allow system administrators to grant or deny operators access to all system physical components such as gateways, sites, controllers, doors, relays, inputs, access levels, reports, schedules, tenant lists, video servers, card types using workspaces. This allows greater ease for larger sites to locate and assign components that pertain to specific gateways and sites. System administrators shall be able to tailor specific system applications and workstations Workspaces, therefore restricting access to information to all levels of operators. Operators shall be able to use temporary workspaces to narrow their fields of view when accomplishing specific tasks, and then easily revert back to their main workspace.

6. The SMS shall allow the configuration of a system wide feature that will automatically disable an operator who has not logged in at least once in X days.
 - a) The SMS administrator shall have the option to customize the inactivity timer from 30 days to 365. The SMS feature can also be turned off by the SMS administrators
 - b) The SMS shall automatically notify the operator via e-mail 10 days prior to the deactivation.

H Report Section

1. The SMS shall include templates for various types of reports to include the following:
 - a) Card use reports.
 - b) Manual operations reports.
 - c) Alarm reports.
 - d) Historical reports.
 - e) Time & attendance reports.
 - f) Detailed reports.
 - g) Summary reports.
 - h) Statistical reports.
 - i) Roll call reports.
2. The SMS shall allow for the creation of custom reports based on any event or component in the system. The SMS shall support an unlimited amount of customized reports.
3. All reports shall be able to be displayed on screen, printed, or sent by e-mail on a daily, weekly, or monthly basis. All event reports can be automated to be generated and sent at a specific time for a specific time period.
4. The SMS shall support at a minimum the following report formats: Sybase, Dbase IV, CSV, XLS, PDF, RTF, and TXT.
5. The SMS shall be able to generate an access report in CSV with all the card information associated to that access event.
6. All component modification events shall be tagged with addition (+), modification (=) or deletion (-) tag. In all event driven reports the operator shall have the choice to specify a tag or all tags in order to further filter report.

7. The system shall support for the creation of custom time and attendance reports. Each time and attendance report shall support up to 32 rules for masking the entry and exit times of each card. Also each report shall support a "First entry and last exit" feature.
8. Time and attendance reports shall have the possibility to compile the report in using fractions base (percentage) or actual hours and minute base.
9. The SMS shall allow the creation of custom roll call reports, which can without operator intervention be e-mailed to multiple people and/or printed on multiple printers. The roll call report shall be a system wide feature.
10. Each report, quick report, historical report and time attendance report shall have a priority number assigned to it. When multiple reports are requested. The SMS shall prioritize the creation of the report based on their priority number. From the report queue management window the operator shall have the possibility to promote the report to a higher priority. The operator shall also have the ability to request more processing power from the computer in order to expedite the report creation.
11. Reports shall be prioritized from queue of 1 to 99. When the report is requested as priority one it shall be processed first. The default value for all new reports shall be set to 50. Operators shall be able to change it as needed.
12. The SMS shall have a statistical window showing all reports executed, the time of execution, the time lapse, the number of events, the requestor, and the application request. The report shall be exportable in CSV format.

I Help Section

1. The SMS shall have a contextual help button in every window. The operators shall also have the option of pressing F1 on their keyboard and the help window will appear with the correct section of the item they were looking at in the SMS.
2. The SMS shall include an about window which shall include basic information about the SMS. It shall also include the KAP start/end date and tokens needed. The operator shall be able to send KAP details via e-mail to a pre-defined e-mail list by the click of one button.
3. In addition the about window shall include contact information for the SMS manufacturer and contact information for the installation company/dealer. In addition the SMS shall support to identify the SMS to the customer with his contact information. The dealer information shall at a minimum but not limited to:

- a) Company name.
- b) Address.
- c) Website link.
- d) E-mail link.

J Options Section

1. The SMS shall allow operators to access basic server and display functions and allow the operator to determine default settings for the server hard drive. The operator shall also be able to determine the time to perform a server backup, programmable on monthly, weekly, or daily basis. It shall be possible to schedule and plan mass automatic KT-400 and KT-1 firmware updates.
2. The SMS shall allow for the servicing company to enter their contact information for the SMS operator's disposal.
3. The SMS shall allow system administrators to put the SMS in a read-only mode. When the SMS administrator puts the SMS in read-only mode, the SMS operators are visually notified. In addition SMS operators can no longer perform changes or add components in the SMS. The SMS operators are allowed to receive events, perform door operations such as, but not limited to unlocking, locking, and temporary unlocking.
4. The SMS shall allow system administrators to put the SMS in a maintenance mode. When the SMS administrator puts the SMS in maintenance mode, the SMS operators shall be able to perform their regular actions based on their rights but will not receive pop-ups and real-time e-mail notifications.
5. The SMS shall allow system administrators to easily migrate ioProx extended facility code secure format (XSF) cards from a seven character HH:DDDDD to a HHHH:DDDDD format without downtime.
 - a) The SMS shall allow the system administrator to convert automatically all ioProx XSF cards to an extended facility code secure format of their choosing. The SMS shall change all the card programming instantly.
 - b) The SMS shall allow the system administrator to run a conversion tool that will convert ioProx XSF and ioSmart cards in real time into their proper extended facility code secure format without having any down time.

- i) This process shall have the option to be turned on or off as the system administrator wishes.
 - ii) The cardholder would need to swipe the card twice, the first time the process is started.
 - iii) The conversion shall be in real time, and take less than one second per card to occur.
- c) The SMS extended facility code secure format conversion is optional, as the SMS shall support standard HH:DDDDDD or other formats supported.

K System Status Section

1. The SMS shall allow operators to view the state of various access system components in text or numerical form. A specific controller's state shall also be able to be viewed in graphic form via the picture of the controller with the status of each terminal. Workstation and database status shall also be able to be displayed.
 - a) The SMS shall offer an active status count of all operators in the SMS.
2. The SMS shall offer the ability to run reports on login counts so that operators can run trends on operator peak usage.
3. The SMS shall offer the ability to have a window displaying all the current logins in the SMS. The SMS logins shall be filterable and sortable by type of application such as Web, mobile workstation or database applications.
 - a) The SMS all allow the operator to force logout operators thus ending immediately their sessions in the workstation, web and mobile clients.
 - b) The SMS all allow the operator to force logout and permanently disable the operator thus ending immediately their sessions in the workstation, web and mobile clients. The operator won't be able to login until reactivated manually.
 - c) The list shall be exportable in CSV file format.

L Various Tools

1. The SMS shall employ an express setup to configure system components such as sites and controllers, as well as peripherals associated to these components such as ports and inputs. This utility will reduce the programming time to a minimum.
2. The SMS shall employ a database utility to allow the re-indexation and verification of archived files and verify the integrity of indexes, links, and database arborescence.

3. The KT-Finder tool shall help troubleshoot the Kantech IP Link, KT-1 and KT-400 on site or remotely. It can also be used as an alternate method of configuration for both.
4. The SMS shall include a vocabulary editor to be used in designing custom language dictionaries.

M Video Vault

1. Video vault is an optional remote networked application used to automate recovery of video data from the DVR/NVR and save it on a disk for long term video storage and retrieval. The information can be stored on an independent system or within the server. The footage that shall be tagged and recoverable from the DVR/NVR shall include SMS triggers, manual triggers, and saved video server footage.
2. For the archived video files it shall be possible to complete the following:
 - a) Assign a folder name to index the archived files.
 - b) Create sub folders based on day of the week, day, week, month of the year, month, video server name, camera name and/or event description name.
 - c) Determine the hard drive to store the recovered videos.
 - d) Determine the composition of the name of the saved file.
 - e) Determine the format of the saved video.
 - f) Assign a frame from the saved video to represent as a saved file.
 - g) Determine the number of simultaneous downloads.
 - h) Determine a size limit for recoverable videos.
 - i) Assign a password to videos stored.
 - j) Determine a delay between requests to the server.
3. There shall be scheduled transfers for archiving thereby reducing video network traffic during peak times.

Section 2.05 PERFORMANCE – WEB/MOBILE APP

A EntraPass Web

1. EntraPass Web shall be an optional tool that will allow for performing certain functions from a remote location to be used with the regular SMS system via a Web browser.
2. EntraPass shall be Silverlight based and be a download application from the main web server. The operator shall simply have to run the EntraPass Web from their desktop.

3. EntraPass Web shall be updated automatically when the main web server is updated.
 - a) Manual updating of EntraPass Web shall not be supported.
4. The EntraPass Web interface shall allow the operator to have a favorite list of connections. The operator shall be able to select from the favorite list of servers and logins. A username and password shall be required for each one.
5. The EntraPass Web operator transactions such as modifications and operations shall be sent to the SMS in the local time zone operator is in.
6. EntraPass Web shall offer the following operations:
 - a) Operator specific security rights. The SMS workstation shall allow configuring operators to be able to access EntraPass Web. It shall also allow the operator's security rights and workspaces to be used on the EntraPass Web. An operator who cannot add cards on the SMS workstation shall not be able to do the same on EntraPass Web.
 - b) Automatically adjust the operator's language selection. The language selection shall be done at the creation of the operation in the SMS workstation. The languages supported shall be English, French, Spanish, Italian, Portuguese, Simplified Chinese, Dutch, Turkish and German.
 - c) There shall be no limits to the amount of EntraPass Web that can be installed.
 - d) Shall not require any kind of refreshing to receive any new data
 - i) Refreshing the "page" shall not be supported.
 - e) EntraPass Web licenses shall be managed by concurrent active logged on sessions.
 - i) The need to have dedicated licenses per computer shall not be supported.
 - f) Shall support right-clicking to allow additional functions.
 - g) Shall include onscreen overlay tutorials to help guide the operator on how to use the user, access level, holiday, tenant, schedule, dockview windows and others.
 - i) The tutorials shall be simple, easy and straight to the point. The tutorial overlay shall fade out when the operator actively moves in the screen.
 - ii) The tutorials shall have the ability to be turned off if no longer needed.
 - h) Shall include context-sensitive help in a separate window to provide complete help on specific topics.
7. EntraPass Web shall have a complete, easy to use and intuitive look and feel.

8. EntraPass Web shall allow the following for door, relay and input menus:
 - a) The operator is allowed to select multiple components using the SHIFT/CTRL buttons on the keyboard and the mouse.
 - b) The operator is allowed to view real-time status of the components. Systems righting a manual refresh shall not be acceptable.
 - c) The operator is allowed to search for a particular component within the site. The search filter shall update the results as the operator types.
 - d) Retrieve the last site visited and load the same site when revisiting the menu.
 - e) On doors the operator shall be able to:
 - i) Unlock/lock a door.
 - ii) Use the one time access functionality (pulse door).
 - iii) Temporarily unlock a door.
 - iv) Return to schedule
 - v) Enable/disable exit/entry readers separately using the same door icon.
 - vi) Arm/disarm doors when using the KT-400, KT-1 and alarm panel.
 - vii) View full text status.
 - viii) Enable/disable floors when programmed as elevator.
 - ix) Change unlock schedule for the door.
 - x) Clear unlock schedule for the door.
 - f) On relays the operator shall be able to:
 - i) Activate relays
 - ii) Deactivate relays
 - iii) Temporarily activate relays
 - iv) Retrieve the initial door schedule.
 - g) On inputs the operators shall be able to access the following features:
 - i) Normal supervision
 - ii) Continuous supervision
 - iii) No supervision
 - iv) Temporary no supervision
9. EntraPass Web shall provide complete card management.

- a) EntraPass Web shall learn and remember the operator's screen settings.
 - i) It shall be possible to see all settings of the cardholder at once without the need to use tabs.
 - ii) Its fields shall be grouped in a logical order to allow operator to completely accomplish their tasks without moving around the window.
- b) The EntraPass Web shall support up to a total of five access levels for each card user per site/connection when using the Multi-site gateway. This feature shall be available with the KT-400 and KT-1. The SMS shall advise the operator if doors are not supported when adding additional access levels (2-5).
- c) The EntraPass Web shall allow adding door access exceptions to the cardholder's list of access rights.
- d) EntraPass Web shall allow configuring every aspect of the card that the EntraPass Workstation offers.
- e) The EntraPass Web shall allow for operators to manage the user's goPass.
- f) The EntraPass Web shall allow for operators to manage the user's HID Mobile Credentials.
- g) EntraPass Web shall allow the operator to print badges using dye- sublimation printers (badge printers).
 - i) The operator shall be:
 - 1) Able to assign a badge template to a user.
 - 2) Able to preview both sides of the card printing.
 - 3) Assign a badge printer to print on.
 - 4) Able to print both sides, back side only or front side only.

- h) EntraPass Web shall include additional operations for the cardholder:
 - i) Link a cardholder to a tenant list for the KTES.
 - ii) Import and take a picture of the cardholder using a web cam.
 - iii) View a list of cardholders.
 - iv) The cardholder list shall be configurable to include cardholder information. It shall also allow to sort by columns.
 - v) The cardholder list shall allow for a right click function to modify or delete the cardholder.
 - vi) Search by card number and username.
 - vii) Import and export cardholders using CSV.
 - viii) View all doors assigned to a cardholder regardless of an access level.
 - 1) The door list shall be printable and exportable in PDF or EXCEL (XLS) formats.
- 10. EntraPass Web shall provide complete access level management.
 - a) EntraPass Web shall allow the operator to customize their access level list to show more access levels in columns in order to provide a better view of the access levels.
 - b) EntraPass Web shall provide a preview on how the access level is programmed:
 - i) It shall be possible to zoom in the access level preview and see down to the hour how the access level is programmed.
 - c) The EntraPass Web shall allow operators to add quickly a door to a list of access levels.
 - i) The operator shall select a door and see a list of access levels.
 - ii) The EntraPass Web shall return to the assigned door shown on the schedule. If the door is not assigned to an access level, it shall show none.
 - iii) The operator shall be able to change any of the doors assigned access levels by simply changing the schedule.
- 11. EntraPass Web shall provide complete schedule management.
 - a) EntraPass Web shall allow the operator to customize their schedule list to show more schedule in columns in order to provide a better view of schedule.

- b) EntraPass Web shall provide a preview on how the schedule is programmed.
 - i) It shall be possible to program quickly the schedule by either entering the times or using a scroll bar.
 - ii) It shall also be possible to quickly program the days by choosing them manually or selecting pre-defined day templates.
- 12. EntraPass Web shall provide complete holiday management.
 - a) EntraPass Web shall allow the operator to customize their holiday list to show more holidays in columns in order to provide a better view of holiday.
 - b) EntraPass Web shall provide a preview on how the holiday is programmed.
 - i) It shall be possible to program the holiday date and using the drag and drop function to select the appropriate sites affected.
- 13. EntraPass Web shall provide complete tenant and tenant list management.
 - a) EntraPass Web shall allow the operator to customize their tenant list to show more tenant lists in columns in order to provide a better view of tenant lists.
 - b) EntraPass Web shall allow for complete tenant programming in an easy to use GUI interface.
 - c) It shall be possible to see all tenant settings at once without the need to use tabs.
- 14. EntraPass Web shall allow for map management.
 - a) The operator shall be able to use easily and intuitively the map creation tool to import floor plans or maps in EntraPass Web. The image formats support shall be JPEG and GIF.
 - b) The operator shall have the ability to place components on specific parts of the map and assign double click actions.
 - c) The operator shall be able to view maps from their screen.

- d) The operator shall be able to:
 - i) See real time visual status of a component. At a minimum the following components shall be available:
 - 1) Doors and elevators
 - 2) Inputs
 - 3) Relays
 - 4) Map links
 - 5) Virtual keypad
 - 6) Controller
 - 7) Video Cameras
 - ii) Double click on the component to perform actions.
 - iii) Right click on the component and choose a different action.
 - iv) Quickly move to different maps by using links.
 - v) Maximize the map. EntraPass Web shall be able to keep the visual aspect ratio.
 - e) EntraPass Web shall remember the last map used and load it so that operators do not need to choose a map to start every time.
 - f) The operator shall be able to modify the assigned door schedule from the map.
 - i) The operator shall not need to have access to entire door to be able to change the assigned door schedule.
 - ii) Changing the door schedule shall be a privilege that can be turned on or off by the SMS administrator per operator.
15. The EntraPass Web shall allow for operator programming and management.
- a) The EntraPass Web shall allow to create, modify, delete and view operators.

- b) The EntraPass shall allow the following but is limited to operator management:
 - i) Operator display name
 - ii) Operator login name
 - iii) Operator password following the SMS password complexity rules.
 - iv) Language
 - v) Security level
 - vi) Workspace
 - vii) Password reset
 - viii) Password last set every X days.
 - ix) Disable operator X consecutive bad logins.
 - x) Maximum passwords before change.
 - xi) Account expiration date
 - xii) Picture
 - xiii) E-mail
 - xiv) Disable operator
 - xv) Welcome e-mail settings
 - c) The EntraPass Web shall allow to send a welcome e-mail to the SMS operator.
 - d) The EntraPass Web shall allow the SMS operator to re-send the welcome e-mail as needed.
 - i) This welcome e-mail shall include links to pair automatically the SMS operator with the following SMS applications: link to download the EntraPass Web.
 - ii) Link to download and pair the SMS operator automatically to EntraPass Go for Apple® and Android® devices.
 - iii) Link to download and pair the SMS operator automatically to EntraPass Go Install for Apple® and Android® devices.
16. EntraPass Web shall provide video integration with the American Dynamics HDVR and VideoEdge (NVR), Intevo Advanced, Intevo Compact and exacqVision A-Series, exacqVision Z-Series, exacqVision EL-Series (EL-S, ELX-S, ELX-IP, ELX-SR) and the exacqVision LC-Series (LC, LC-IP) IP DVR/NVR products.
- a) EntraPass Web shall allow the operator to complete the following:
 - i) To create and manage video views.
 - ii) To select a single camera and drag it into the viewing screen to view live video.

- iii) To select a predefined video view and drag it into the viewing screen to view live video.
 - iv) To view video cameras without the need to create video views.
 - v) To select nine different video camera layouts.
 - vi) To support up to 16 cameras at once per view.
 - vii) To video search for up to one hour.
 - viii) To video search exporting in watermarked or AVI format.
 - 1) The watermarked format shall include a video player embedded in the clip.
 - ix) To video search using metadata to only show alarm clips based on camera motion alarms or access event video recording clips, thus speeding up finding video alarms for the customer.
 - x) To PTZ control cameras using the mouse or computer keyboard (arrows for pan/tilt and +/- for zoom in/out).
 - 1) The PTZ shall offer three speeds based on mouse movement.
17. EntraPass Web shall allow the operator to generate reports:
- a) All reports shall be sent using e-mail to multiple e-mail addresses in PDF or EXCEL (XLS) format.
 - b) Reports shall also be viewable on the EntraPass Web screen. The operator shall still be able to use EntraPass Web while a report is generating.
 - c) On screen viewed reports shall allow the operator to print the report and save it in PDF or EXCEL (XSL) formats.
 - d) Reports shall allow additional filtering within the report values to better accommodate report filtering.
 - e) EntraPass Web shall allow generating quick reports.
 - i) Quick reports are pre-defined event templates among which operators can choose. The operator shall be able to select multiple event templates.
 - ii) Quick reports shall offer the following pre-configured event templates:

- 1) All events
 - 2) Access events
 - 3) Alarm system events
 - 4) Area events
 - 5) Camera events
 - 6) Controller events
 - 7) Database events
 - 8) Door events
 - 9) Guard Tour events
 - 10) Input events
 - 11) KTES Events
 - 12) Operator events
 - 13) Relay events
 - 14) Server based events
 - 15) Time and attendance based events
 - 16) Video server based events
- iii) The operator shall have the ability to choose a specific timeframe based on date and time.
- f) EntraPass Web shall allow the creation of custom reports:
- i) Custom reports shall be built in the SMS workstation and can be used in EntraPass Web
 - ii) The operator shall have the ability to choose a specific timeframe based on date and time.
 - iii) Custom reports shall be of limitless availability to the operator.

- g) EntraPass Web shall allow the creation of reports based on user lists
 - i) The operator shall be able to quickly filter the user list based on:
 - 1) The entire card database
 - 2) Door access
 - 3) Assigned card type
 - 4) Assigned access level
 - ii) The operator shall also be able to filter the report based on:
 - 1) One user definable field with a search value
 - 2) Card status
 - a. Enabled/disabled
 - b. Lost/stolen
 - c. Postdated
 - d. Expired
 - e. Suspended
 - 3) Comments
 - 4) Card traced
 - 5) To be deleted when expired
 - 6) Wait for PIN
 - 7) PIN search
 - iii) Allow the operator to choose which values to include to the report. These values should include but not be limited to:
 - 1) Username
 - 2) Card number
 - 3) Card type
 - 4) Card filter
 - 5) Picture
 - 6) Access level
 - 7) Card information fields (selectable)
 - 8) Card state
 - 9) Start/end date
 - 10) Count values
 - 11) Card parameters
- h) EntraPass Web shall allow the creation of a doors “assigned to” report:
 - i) The operator shall be able to quickly filter the report based on:
 - 1) The access level
 - 2) The card type
 - ii) The operator shall be able to select the component (access levels or card types) to include to the report.

- iii) The report output shall include the access level or card type name and the doors associated with the schedule.
18. EntraPass Web shall allow the operator to view events in real time.
- a) EntraPass Web shall allow the operator:
 - i) To view events in real time. Each event at a minimum shall include:
 - 1) Date and time
 - 2) Event name
 - 3) Description of the component.
 - b) The event viewer shall support natively a swipe and show feature. The picture of the cardholder shall appear on access related events.
 - c) On predefined video alarm recordings, a video button shall appear on the event screen for each event that has video alarm.
 - i) The operator shall be able to click the button to view the alarm video clip.
 - d) From the event viewer the operator shall be able at a minimum to:
 - i) Search for any event, date, time, description using the filter field
 - ii) Sort by date/time, event and description.
19. EntraPass Web shall allow for the DSC PowerSeries, Maxsys and Simplex Fire 4100ES Virtual keypad to be used. From the maps or dedicated menu the operator shall easily be able to bring up a fully functional DSC Virtual keypad and perform all actions allowed by the DSC PowerSeries 1616, 1832, 1864 keypad and Maxsys keypad.
20. The EntraPass Web shall allow for the DSC PowerSeries, Maxsys and PowerSeries operators to:
- a) View partition status
 - b) Arm and disarm partitions
 - c) View zones status
 - d) View and control the virtual keypad from the DSC PowerSeries 1616, 1832, 1864 and Maxsys.

21. EntraPass Web shall allow for the programming of Kantech hardware.
 - a) EntraPass Web shall support but not be limited to programming the following:
 - i) Sites
 - 1) Naming a site
 - 2) Adding user definable fields, to best describe the sites.
 - 3) View linked connections
 - ii) IP connections
 - 1) IP Link
 - 2) KT-400 IP
 - 3) KT-1 IP
 - 4) KTES IP
 - iii) Direct connections
 - 1) USB or Serial
 - iv) Controllers:
 - 1) KTES
 - 2) KT-100
 - 3) KT-200
 - 4) KT-300

- 5) 5. KT-400
- 6) 6. KT-1
- v) ioSmart readers configuration in the controller menu
 - 1) Configuring ioSmart Readers to the KT-400 and KT-1 controllers.
 - a. Assigning an ioSmart reader via serial number to a door.
 - b. Configuring input and outputs settings on ioSmart readers.
 - c. Configuring keypad settings
 - vi) Door programming including but not limited to:
 - a. Multi-swipe settings
 - b. Intrusion arming/disarming
 - c. Unlock/open settings
 - d. Door contact and REX settings
 - e. Schedule assigned
 - f. Door naming
 - g. First Person in with grace period.
 - h. Exit/entry readers per door with KT-400.
 - 2) Relay programming including but not limited to:
 - a. Activation schedule
 - b. Disable relay schedule
 - c. Temporary activation timer
 - d. Relay naming
 - 3) Input programming including but not limited to:
 - a. Monitoring schedule
 - b. NC/NO status
 - c. Relay activation settings
 - d. Input Name
 - 4) Firmware updates request to the controllers so that the SMS shall update them to the latest firmware provided.
- b) When using the KT-1 with the auto-enrolment feature
 - i) The auto-enrolment shall work on a local LAN segment of the network.
 - ii) The EntraPass Web shall display in dedicated list all unassigned KT-1. From the EntraPass Web. The operator shall simply pick the KT-1 they are interested in.
 - iii) The EntraPass Web shall allow using the auto-enrolment wizard:
 - 1) Assign a KT-1 to a site.
 - 2) Name the door
 - 3) Activate the exit reader.
 - 4) Activate the door contact.
 - 5) Activate the request to exit.

- c) EntraPass Web shall support a quick, intuitive and easy to use express setup to configure controllers and their doors, relays and inputs.
 - d) The operator shall be able to modify, delete or add components manually after the express setup.
 - e) The operator shall be able, at a glance, to see in a visual and easy to understand the site communication time, communication status and the number of controllers communicating.
 - i) The operator shall also be able to see the communication status per controller.
22. EntraPass Web shall provide e-mail notification and alarm management with the watchlist.
- a) EntraPass Web shall have the ability to select manually which door, relay, input and elevator will be watched for abnormal events.
 - b) A watched component shall generate an alarm on EntraPass Web. The operator shall have a time ticker (watchlist) where all the alarms will appear as small colored circles.
 - i) Each event shall be categorized with the appropriate color by the SMS.
 - c) The operator shall be able to see watchlist events regardless of the time zone difference between the event and the EntraPass Web instance.
 - d) The operator shall be able to:
 - i) Highlight the event and see more information that shall appear.
 - ii) Right click on the event and go to associated:
 - 1) Component
 - 2) Video recording
 - 3) Map
 - iii) Scroll back to the first alarm since he logged in to an EntraPass Web session.
 - iv) Shall be able to tag a watchlist with e-mail notification as well.

23. EntraPass Web shall provide dockviews.
 - a) The operator shall be able to create unlimited amount of dockviews.
 - b) Each dockview shall be customizable to the operator's specifications. A dockview can be customized to have any of the following features configured, but will not be limited to the following items:
 - i) Naming the dockview
 - ii) Schedule management
 - iii) Access level management
 - iv) Holiday management
 - v) User management
 - vi) Tenant management
 - vii) Door/elevator operations
 - viii) Relay operations
 - ix) Input operations
 - x) Events
 - xi) Maps
 - xii) Video viewing
 - xiii) Reports
 - c) Each dockview shall perform the following:
 - i) Pin as favorites.
 - ii) Make floating views usable on multiple screens embedded in EntraPass Web.
 - iii) Assign to various operators.
 - iv) Retrieve the last map used so that operators do not need to reselect the map.
 - d) The operator shall have the ability to open an unlimited number of Dockviews at the same time when they are setup as floating views.
24. EntraPass Web shall at a minimum be supported by any Web browser and Windows® OS supporting Microsoft® Silverlight plug-in.
25. The SMS administrator shall be able to change the EntraPass Web highlight color, and the splash screen title and image of the login page.

B Mobile APP - EntraPass Go

1. Mobile App is an optional tool that will allow performing certain functions from a remote location to be used with the regular SMS system via iPad, iPhone, Android phones and Android tablets. The mobile app provides card management to guards, secretaries, or managers without the need to deploy a full workstation. A concurrent connection option shall provide access to a predetermined number of simultaneous users.

2. The concurrent connections are shared with the EntraPass Web connections.
3. The EntraPass Go operator transactions such as modifications and operations shall be sent to the SMS in the local time zone operator is in.
4. The mobile app shall have the ability to be viewed in multiple languages. The mobile app shall be available in English, French, Spanish, Italian, Portuguese, Simplified Chinese, Dutch Turkish and German. The languages shall be preselected based on the device language.
5. The following functions are available using mobile app:
 - a) Card management (including five cards per username) including but not limited to.
 - i) Card names.
 - ii) Card numbers.
 - iii) Card expiry hour.
 - iv) Go Pass management.
 - v) Access levels.
 - vi) User pictures.
 - vii) Access levels.
 - 1) Secondary with expiration date when using a global gateway.
 - 2) Additional access level when using a multi-site gateway
 - 3) Access door exceptions.
 - 4) Forty card fields to best describe the user.
 - 5) Start/end date.
 - 6) PIN.

- b) Live cardholder picture capture using a camera.
 - c) Create, modify and delete access levels.
 - d) Create, modify and delete schedules.
 - e) Assign access levels.
 - f) Perform door operations.
 - g) Change the unlock schedule of the door.
 - h) Perform relay operations.
 - i) Perform input operations.
 - j) Perform elevator operations.
 - k) Request historical or quick reports via e-mail.
 - l) View live events using the menu or the quick launch viewer.
 - m) Search for events using text filters.
 - n) Arm and disarm DSC partitions.
 - o) View DSC zone status.
 - p) For exacq or Intevo video management systems:
 - i) Live video view in portrait and landscape mode.
 - ii) Video search.
 - iii) Video alarm clip view on access events. When video is available on the access or DSC event, a camera icon shall appear and operators shall be able to click on this icon and view the video alarm.
6. The mobile app shall offer the ability to perform quick actions for efficiency; this will include the ability to expand the menu to perform all associated actions.
7. The mobile app shall have a home screen that can perform door, DSC actions and view video without having to change menus.
8. For Apple® devices that allow thumbprint login, the mobile app shall allow login using this thumbprint. No extra information is required.
9. The mobile app shall support multiple SMS logins and servers stored in memory.
10. The SMS shall support gesture logins in order to login securely and quickly to the Mobile App.
11. The mobile app shall be downloadable at no-charge from the App Store® and Google Play®.
12. The Mobile App shall be supported but will not be limited to the following:

- a) Apple:
 - i) iOS: 11.4
- b) Android:
 - i) OS:
 - 1) Kitkat
 - 2) Lollipop
 - 3) Marshmallow
 - 4) Nougat
 - 5) Oreo

C Mobile APP - EntraPass Go Pass

1. EntraPass Go Pass is an optional tool that will allow cardholders with this privilege to use their smartphone Apple® or Android® devices as their credentials.
2. EntraPass Go Pass simulates a card swipe by sending the request over WI-FI or mobile data to the SMS Smartlink. The SMS sends the request to the controller; the controller devices then generate access or not to the door based on the real time door status.
 - a) The SMS controller shall have the final say to unlock the door and the EntraPass Go Pass request shall follow every rule of the door.
 - b) EntraPass Go Pass shall work on any Kantech controller.
 - c) EntraPass GO Pass shall not be tied to work on specific readers.
3. The EntraPass Go Pass is paired to a SMS cardholder using encrypted one time use e-mail. The encrypted e-mail can only pair one smartphone at a time. A second smartphone trying to pair itself with the SMS cardholder shall be automatically rejected.
 - a) The SMS operator can issue a new encrypted e-mail. Once this is done the first smartphone is unpaired automatically and EntraPass Go Pass stops working. The new smartphone can be paired.
 - b) The SMS operator can completely revoke the EntraPass Go Pass credential if needed.
4. The EntraPass Go Pass shall display all the doors assigned to the cardholder (using the access level).
 - a) The doors shall be listed by site where the EntraPass Go user shall be able to expand the list and see the doors within the site.
5. The first time an EntraPass Go Pass user goes to the door, the EntraPass Go Pass shall ask if they are onsite so that the EntraPass Go Pass can tag the location of the site.
6. Site lists shall be ordered by location distance and not alphabetical.

7. EntraPass Go Pass shall be able to place their popular doors in the Favorite window for quick access.
8. EntraPass Go Pass can be extended to be used with Apple® Watch.
 - a) The EntraPass Go Pass user shall be able to open their app and request their favorite doors to be unlocked.
 - b) The user's EntraPass Go Pass favorite doors can be placed as widgets on Apple® and Android® smartphones for quick access.
9. The concurrent connections are shared with the EntraPass Web connections.

Section 2.06 INTEGRATION

A SmartLink

1. The SmartLink application offers the ability to send messages to pagers and cell phones by e-mail. SmartLink provided instant e-mail notification of alarm events and the ability to e-mail reports.
2. Integration with other systems can also be done through the SmartLink API. This tool is used for advanced integration with third party applications like visitor management software, human resources systems, time and attendance systems, video systems, and HVAC.

B Card Gateway

1. The card gateway is an optional external interface that shall allow the client to make modifications to the system card database through an Oracle or MS-SQL database. The application can be installed and run on the server's CPU. It shall allow for HR software integration and enable operators to modify, add, or obtain information on cards in real time.

Section 2.07 REDUNDANCY & MIRRORING

A Redundant Server

1. The SMS shall be able to support an optional redundant server whose main function shall be to monitor the primary server and ensure automatic (hot standby) take over if necessary. The redundant server shall have all the same characteristics and functions as the primary server.

2. The transition between these servers shall be completely transparent. When the primary server is operational once more, it shall be capable of synchronizing its database automatically with the redundant server and then resume absolute control of the access management system. No human intervention shall be required in this operation.
3. The operator shall be able to perform any and all operations during a fail-over synchronization between the primary server and redundant server.
4. The system shall support the use of multiple simultaneous redundant servers. The need to install third party (not EntraPass) licensing shall not be acceptable.
5. The SMS shall no longer allow the primary server to run and manage quick and custom event based reports. The quick and custom reports shall be managed by the active redundant server. This gives power to the primary server to manage the database and day-to-day operations.
6. The SMS shall allow the redundant server to perform backups.
7. The SMS shall allow for asynchronous and synchronous mirror database of archives, time-attendance and video events. This allows for slower networks where the redundant server is in a different building or city to only sync events every X minutes. The timer shall be configurable:
 - a) In case of primary server failure the redundant server shall start and take over. The database (data) is synchronized in real time at all times.
 - b) Once the primary server restarts, the missing event shall be fully synchronized.
8. The SMS shall synchronize all redundant servers instances at the same time and not in sequence.

Section 2.08 HSPD-12 COMPLIANCE AND INTEGRATION

- A The SMS shall be HSPD-12 compliant when integrating with PIVCheck Plus and Certificate Manager Solution. The SMS and PIVCheck integration shall be seamless and the operator shall not need to enter the cardholder's information twice.
- B The integration shall support up to three-factor authentication, extraction and verification of the cardholder's data on the FIPS 201 smart card and shall perform a biometric match against the template stored on the card. Digital certificates shall verify against the issuer's validation authority, SCVP or OCSP Responders. All cards shall be validated using the FIPS 201 challenge-response (CAK or PAK) in order to identify forged or cloned cards. The SMS integration shall work with all PIV, TWIC, CAC and FRAC cards.

- C The PIVCheck solution shall verify the following items to ensure that the cardholder is the card owner, the card is authentic, and the card has not been revoked by the agency that issued it:
 - 1. Smart card expiration date.
 - 2. Non-duplicated card (forged/cloned).
 - 3. Biometric.
 - 4. Certification status.
 - 5. PIN verification.
- D The SMS shall natively support the FIPS 201 driver when using the KT-400 and KT-1 controllers and shall display the FIPS 201 card number correctly.
- E The SMS integration shall allow associating SMS card fields with the PIVCheck card field in order to have a seamless cardholder entry. The SMS integration shall allow but not limited to associating with the following fields:
 - 1. User definable fields (ten).
 - 2. Cardholder pin.
 - 3. Card number.
 - 4. Card user name.
 - 5. Card type.
 - 6. Card status.
- F The SMS integration with PIVCheck shall require option codes to activate all integration functions.

Section 2.09 OPERATION

The SMS shall perform the following tasks:

- A Allow card access management for one or more buildings.
- B Control access to various doors equipped with a card reader. Allow the ability to set card use count options to limit the number of times a card can be used.
- C Monitor all defined alarm points as well as all doors controlled by card readers based on programmed schedules.
- D Send transactions for which printing is required to one or more printers, based on a set schedule.

- E Access the system using the main and secondary menus (to which access is limited by a password) to make additions and required changes to various data files so that they can be updated by the user without the manufacturer's assistance.
- F Enable the entry of access code data for every card or group of cards.
- G Seamlessly connect to onsite alarm systems.
- H Fully functional virtual keypad with DSC® PowerSeries PC1616, PC1832 and PC1864 alarm system in addition with the DSC MAXSYS 4020 alarm panel. The operator shall perform all functions available on a standard keypad with the PowerSeries or MAXSYS 4020 series alarm systems. The operator shall be able to use the computer keyboard or the mouse to perform actions on the virtual keypad.
- I Interface with the Simplex 4100ES Fire Panel, thereby eliminating hardwired integration between the SMS controllers and the Simplex 4100ES fire panel to receive events from the Simplex 4100ES panel and view the virtual keypad.
- J Associate to each event a recording schedule for each destination (hard drive, monitor).
- K Automatically display all alarms on screen in text with optional graphic or picture and trigger a sound requiring an acknowledgement on the keyboard to stop the alarm.
- L Alarm pop-ups can be sent to many workstations. An alarm pop-up shall be acknowledged once by one operator.
- M Mandatory comments can be added by the operator when acknowledging the alarm pop-up.
- N In the case of an unacknowledged alarm within a customizable time; the alarm shall be sent to all active operators with additional log information.
- O Each event shall print on a log printer. For security reasons, each event shall be incremented with a print number. Numbering shall start from zero every day.
- P Generate reports and view them on the screen, output them to a printer, or send them to an e-mail address.

- Q Supervise based on programmed schedules of specific points such as door contacts, volumetric detectors, mechanical points, high and low temperature sensors, or any other equipment necessary for good building management.
- R View and/or save video images.
- S When integrated into a DVR/NVR system (American Dynamics, Intevo, exacq or Panasonic), allow the management of the recordings of all the cameras via access system workstations.
- T When connected to a DVR/NVR system (American Dynamics, Intevo, exacq or Panasonic), allow the orientation of all PTZ cameras directly using the workstation mouse of the access system.
- U The SMS shall offer the option to create four digit, five digit or six digit PIN for the cardholders.
- V The PIN length shall be defined SMS wide.
- W When connected to a digital video recording system (American Dynamics), allow the recovery and storage of selected videos to an independent server.
- X Save the database manually or automatically backup following a schedule.
- Y Uninterrupted backups. The operator shall be able to perform any task during a SMS backup.
- Z The operator shall be able to perform any and all operations during a fail-over synchronization between the primary server and redundant server.
- AA The SMS shall remind SMS operators via e-mail and messages (pop-ups) of the SMS KAP status. The SMS shall have pre-defined reminders set to:

1. Sixty days before KAP expiration.
2. Thirty days before KAP expiration.
3. Day of KAP expiration.
4. Thirty days after KAP expiration.

BB The SMS KAP reminder shall include but not be limited to SMS serial number tokens needed and SMS Edition.

CC The SMS shall offer administrators to post a message upon operator login. The message shall be customizable to be per operator and system wide.

DD The login message shall be configurable in both SMS languages and appear on the SMS workstation or SMS Web in the operator's respective languages.

EE The login message shall be configurable to specific timeframe (per operator):

1. Never.
2. Always requires acknowledgement.
3. Only one acknowledgement.
4. Always requires acknowledgement until a specific date.
5. Only one acknowledgement until a specific date.

FF The SME administrator shall be able to force strong password rules. The SMS shall allow the SME administrators to select the password settings. Password settings shall be configurable with the following rules:

1. Password length between 8 and 20 characters.
2. Upper case characters between 0 and 20.
3. Numeric characters between 0 and 20.
4. Special characters between 0 and 20

GG When the access control system manages parking lot entry and exit, it shall be possible to set a maximum number of vehicles authorized to simultaneously access the parking area. Once the parking lot is full, the system shall prevent access to any cardholder for as long as a parking space has not become available.

HH Save events on a hard drive according to required criteria.

II The SMS shall allow storing the live transactions (events) portion of the system on a different local drive. This shall speed up performance of the SMS.

- JJ Once activated the SMS shall allow that the each door's request-to-exit events shall be ignored and not stored.
1. The events shall not be stored or viewed on the screen
 2. Operators shall be able to ignore request-to-exit events on a per door basis by schedule.
- KK It shall be possible to program on a KT-400 or KT-1 controller reader to bypass a door contact on a schedule. The bypass shall be at the controller level and at the software level.
- LL It shall be possible to bypass the door contact for door forced events, and door open too long events. It shall be possible to have the door open too long event be an optional bypass on a door basis.
- MM Operators shall be able at any time to bypass the door contact manually from the SMS workstation.
- NN It shall be possible to program on KT-400 controller readers a double and triple switch function.
- OO It shall be possible to have the multi-swipe function activating a predetermined schedule.
- PP The double and triple swipes shall be able to be activated on reader simultaneously each with their respective actions.
- QQ The multi-swipe function shall be able to but not limited to:
1. Toggle door unlock.
 2. Unlock door.
 3. Relock door.
 4. Temporarily unlock door.
 5. Activate Relay.
 6. Temporarily activate relay.
 7. Arm door partition request when using a multi-site gateway.
- RR Each cardholder shall have the option of having the multi-swipe function active.
- SS A specific event shall be generated for any valid or invalid, double or triple swipes.

TT When using ioProx/ioSmart XSF/SSF format readers and the KT-400 controllers the SMS shall support eight readers for four doors.

1. Each door shall have two readers on the same reader port. The installation shall be simple and not require any extra modules to be added.
2. The exit reader of the door shall be wired on the same terminals as the entry reader by simply reversing D0/D1.
 - a) The ioSmart readers shall communicate to the KT-400 over RS-485 on COM2 or standard Wiegand.
3. Power, LED/piezo outputs shall be shared with the entry/exit reader.
4. The SMS shall offer specific exit reader functionalities but not limited to:
 - a) Assigning a specific access level schedule to each reader independently.
 - b) Enabling/disabling the entry/exit reader separately.
 - c) Running reports on the readers separately or together.
 - d) Follow the entry reader door name with a suffix of “-exit”.
 - e) Share the same locking output.
 - f) Share the same door contact.
 - g) Share the same unlock schedule.
 - h) Share the same unlock time and open time.
5. All eight readers shall be used if needed in a controller based anti-passback.

UU First person in, shall unlock the door on a schedule:

1. With the KT-400 and the KT-1 a one hour grace period shall be configurable. The cardholder shall be able to enter within that grace period time and keep the door locked. When the door schedule activates the door shall go on a schedule.
2. If no cardholder has presented their card within the grace period or within the schedule the door shall remain locked.
3. The “first person in” shall be configurable on a per door basis.

VV Save events on a hard drive according to required criteria.

WW Perform the following operations from all workstations:

1. Lock or unlock, one time unlock, return to schedule one door or a group of doors.
2. View the last access event on the door.
3. Bypass the door contact and keep door locked.
4. Temporarily unlock a door using a custom timer for additional door unlocking on KT-400 and KT-1 controller doors.
5. Disable and enable readers.
6. View custom programmed comments in the component's Operation section.
7. Activate or deactivate a relay or a group of relays.
8. Activate or deactivate the recording of one camera or a group of cameras.
9. Activate or deactivate a point or a group of points.
10. Program or modify one card or a group of cards.
11. Assign single door access exception to the card.
12. Validate or invalidate one card or a group of cards.
13. Change time and date.
14. Demand the system state in text or graphic mode.

15. Query, create and/or modify data on: access levels, schedules and holidays, access card, instructions, reports and log, doors, supervision points and relays, operator levels, and graphics.
16. Ability to use an easy to use system tree view to select the components.
17. View, which cards are in the roll call sectors.
18. View the card's last known access in the roll call sector.

XX The operator shall be able to double click on components on the operation screen to automatically view the status in detailed text values.

YY Perform the following operations from the SmartLink Task Commander:

1. Alarm.
2. Disable and enable any reader.
3. Lock, unlock, temporary unlock return to schedule, disable enable any elevator and elevator floor.
4. Activate, deactivate, temporary activate, toggle and return to schedule of any relay.
5. Shunt, unshunt, temporary shunt, toggle, return to schedule and continuous supervision of any input.
6. Set count usage, manually overwrite the count, disable count usage, decrement count usage, and increment count usage for all the cards.
7. Send alarm e-mails.
8. The use of variables in the SmartLink task commander can be used instead of hard coded values.
9. Mass card modifications on without operator intervention.
10. Ability to use generically created commands to perform task on different components.
11. Each specific card shall have the ability to activate a specific component in the above mentioned states without the need to create hard coded the commands.
12. The SmartLink task commander shall process the commands on the first available SmartLink on the SMS.
13. The use of a specific SmartLink to run a specific SmartLink task commander shall not be accepted.
14. The SMS all allow for many SmartLink to be installed without the need to purchase additional option codes.
15. The SmartLink task commander shall be run from any of the available SmartLink.
16. The SmartLink task commander shall allow for single or grouping of components of the same type to trigger the same task. The need to have a specific trigger programmed per component to trigger the same task shall not be accepted.

Section 2.10 EQUIPMENT

A Server and redundant server requirements

The SMS server and redundant server shall meet the following minimum requirements:

1. The server shall have a dual core processor or better.
 - a) If doing video the server shall have an Intel quad core processor or better.
2. The server shall have a 500-watt power unit.
3. The server shall have 4 GB RAM.
 - a) If doing video, the server shall have 8 GB RAM or more.
4. The server shall have 100 GB hard disk drive space at minimum.
5. The server operating system shall be Windows Server 2008 R2, Windows Server 2012 R2, Windows Server 2016, Windows 7, Windows 8.1, or Windows 10. All operating systems shall be 32-bit or 64-bit.
 - a) The integration platform requirements shall possibly change the EntraPass requirements depending on integration products.
6. The server shall have a 100/1000 Base-T network adapter.
7. The server shall have a high quality multilingual keyboard.
8. The server shall have a two button ergonomic mouse.
9. The server shall have an on-off switch.
10. The server shall have an appropriate UPS.

B Multi-site gateway, SmartLink and videovault requirements.

The SMS multi-site gateway shall meet the following minimum requirements:

1. The multi-site gateway shall have a dual core processor or better.
2. The multi-site gateway shall have a 500 watt power unit.
3. The multi-site gateway shall have 4 GB RAM.
4. The multi-site gateway shall have 100 GB hard disk drive space.

5. The server operating system shall be Windows Server 2008 R2, Windows Server 2012 R2, Windows Server 2016, Windows 7, Windows 8.1, or Windows 10. All operating systems shall be 32-bit or 64-bit.
6. The multi-site gateway shall have a 100/1000 Base-T network adapter.
7. The multi-site gateway shall have a high quality multilingual keyboard.
8. The multi-site gateway shall have a two button ergonomic mouse.
9. The multi-site gateway shall have an on-off switch.
10. The multi-site gateway shall have an appropriate UPS.

C Workstation Requirements

The SMS workstations shall meet the following minimum requirements:

1. The workstation shall have a dual core processor or better.
 - a) If doing video, the workstation shall have an Intel quad core processor or better.
2. The workstation shall have a 500 watt power unit.
3. The workstation shall have 4 GB RAM.
 - a) If doing video, the workstation shall have an 8 GB of RAM or more.
4. The workstation shall have 100 GB hard disk drive space.
5. The workstation shall have a 48 x CD-ROM drive.
6. The server operating system shall be Windows Server 2008 R2, Windows Server 2012 R2, Windows Server 2016, Windows 7, Windows 8.1, or Windows 10. All operating systems shall be 32-bit or 64-bit.
 - a) The integration platform requirements shall possibly change the EntraPass requirements depending on integration products.
7. The workstation shall have a 100/1000 Base-T network adapter.
8. The workstation shall have a high quality multilingual keyboard.
9. The workstation shall have a two button ergonomic mouse.

10. The workstation shall have an on-off switch.
11. The workstation shall have an appropriate UPS.

D Controllers

The SMS shall support the following door controllers:

1. Kantech KT-400:

The KT-400 is an Ethernet-ready four-door controller with sixteen monitored points, on-board door strike power, sixteen reader outputs, four relay outputs, and auxiliary power output. It shall accept Wiegand, proximity, ABA clock and data, bar code, magnetic, integrated keypad, and smart card reader types. It shall also support FIPS 201 cards, with and without checking the expiration date. It supports RS-232, RS-485 and 128-bit AES encrypted ethernet 10/100Base-T communication. It supports expansion modules to provide 256 inputs and 256 outputs. It shall support 136 double end of line inputs. It shall support up to support eight card formats (nine with DUAL ioProx driver). The KT-400 shall support 20 native intervals per schedule. The KT- 400 shall support the following native features but will not be limited to them:

- a) Twenty intervals per schedule.
- b) Five access levels per card when connected to a multi-site gateway.
- c) Multi-swipe capabilities.
- d) 100,000 cards in standalone mode.
- e) 20,000 events in standalone mode.
- f) First person in with one hour grace period.
- g) Elevator unlock schedule per floor.
- h) Eight readers, four doors with ioProx XSF readers or ioSmart readers.
- i) Eight Assa Abloy wireless locks (licenses required).
- j) ioSmart readers support over Wiegand or RS-485.

2. Kantech KT-1:

The KT-1 is an Ethernet-ready one door controller PoE/PoE+ with four monitored (single, double, or no end-of-line) points, on-board door strike power, two reader outputs, two relay outputs, and auxiliary power output. It shall support a lock output of 750mA when powered by 12dvc or PoE+. It shall accept Wiegand, proximity, ABA clock and data, bar code, magnetic, integrated keypad, and smart card reader types. It shall also support FIPS 201 cards, with and without checking the expiration date. It supports RS-232, RS-485 and 128-bit AES encrypted Ethernet 10/100Base-T communication. It shall support up to eight card formats.

- a) The KT-1 shall support the following native features but will not be limited to them:
 - i) Twenty intervals per schedule.
 - ii) Five access levels per card when connected to a multi-site gateway.
 - iii) Thirteen access levels per card (12 of them with expiration dates) when connected to a global gateway.
 - iv) Multi-swipe capabilities.
 - v) 100,000 cards in stand-alone mode.
 - vi) 20,000 events in stand-alone mode.
 - vii) First person in, with one hour grace period.
 - viii) Eight Assa Abloy wireless locks, licenses required.
 - ix) ioSmart readers support over Wiegand or RS-485.
- b) The multi-purpose single button shall be used for:
 - i) Auto-enrolling a new KT-1 to the SMS over a local LAN segment
 - ii) Enrolling a new KT-1 to a primary KT-1 over IP (over local LAN segment).
 - iii) Status of the controller's communication, locks and relays.
 - iv) Used as a request-to-exit.
- c) The multi-purpose button shall be LED configurable.
- d) The KT-1 shall be installed in two ways:
 - i) Mountable quickly and efficiently on a single gang installation on the secure side of the door.
 - ii) In a cabinet on a PCB board. This configuration shall support a DSC integration.

E Card and Reader Support

- 1. The SMS shall support configuration of unlimited card formats.
- 2. The SMS shall support up to two card formats per KT-100 and KT-300 controller.
- 3. The SMS shall support up to eight card formats per KT-400 controller or KT-1 controllers
- 4. The SMS shall support readers that provide Wiegand signaling and magnetic ABA signaling to include:

- a) Kantech ioProx family of readers.
- b) Kantech ioSmart family of readers.
- c) Wiegand swipe readers.
- d) Proximity readers.
- e) Biometric readers.
- f) Smart card readers.
- g) Wireless readers.
- h) Magnetic readers.

Section 2.11 EQUIPMENT LIST

Beavercreek Fire Station #65
Security Equipment List

Qty	Description
1	SMS Server w/Software
1	SMS workstation
1	Monitor LCD 19 inch
1	Keyboard and mouse
4	DGP (Kantech KT400 or approved equal)
4	DGP power supply with battery backup
13	Proximity reader with keypad (P325KPW26 or approved equal)
13	Door Contact - Recessed
12	PIR REX

- Abbreviations:
 - SMS – Security Management System
 - DGP – Data Gathering Panel
 - PIR – Passive Infrared Sensor
 - REX – Request to Exit

Article III. PART III EXECUTION

Section 3.01 TESTING

- A The software shall be entered into the SMS computer systems and debugged. The contractor shall be responsible for documenting and entering the initial database into the system. The contractor shall provide the necessary blank forms with instructions to fill-in all the required data information that will make up the database. The database shall then be reviewed by the contractor and entered into the system. Prior to full operation, a complete demonstration of the computer real-time functions shall be performed. A printed validation log shall be provided as proof of operation for each software application package. In addition, a point utilization report shall be furnished listing each point, the associated programs utilizing that point as an input or output and the programs which that point initiates.
- B Upon satisfactory on-line operation of the system software, the entire installation including all subsystems shall be inspected. The contractor shall perform all tests, furnish all test equipment and consumable supplies necessary and perform any work as required to establish performance levels for the system in accordance with the specifications. Each device shall be tested as a working component of the completed system. All system controls shall be inspected for proper operation and response.
- C Tests shall demonstrate the response time and display format of each different type of input sensor and output control device. Response time shall be measured with the system functioning at full capacity. Computer operation shall be tested with the complete data file.
- D The contractor shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built documentation.

Section 3.02 TRAINING

The contractor shall provide a competent trainer who has extensive experience on the installed systems and in delivering training to provide the instruction. As an alternate, the contractor may propose the use of factory training personnel and coordinate the number of personnel to be trained.

Section 3.03 MAINTENANCE

- A The contractor shall offer a Kantech Advantage Program (KAP) to provide twelve additional months of free software updates and online training for the end user.
- B Technical support is available at no charge to all Kantech dealers whether or not they have a KAP activated for the systems they are supporting.

END OF SECTION 28 1300

SECTION 28 2113 - CAMERAS

Note: All items in this section will be provided by the Owner and their security systems vendor. The GC will be required to coordinate with this contractor as the GC is still responsible to run all cabling and provide termination boxes and any required pathways.

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes a True Day/Night Smart/Adaptive IR 3MP imager network IP outdoor mini-dome white vandal camera with single RJ-45 port for HD quality images, True WDR for superior low-light performance, and high-sensitivity low-noise CMOS progressive sensor.
- B. Product: A NVT complaint ONVIF Profile S, standard single lens camera powered by PoE IEEE 802.3af Class 3 (priority source) or 24VAC 12W.
- C. Related Requirements

1.02 REFERENCES

A. Abbreviations

- 1. 2D/3D DNR 2-Dimensional / 3-Dimensional Digital Noise Reduction
- 2. 3MP Three MegaPixel (3,000,000 pixels)
- 3. AEC Automatic Exposure Control
- 4. ARP Address Resolution Protocol
- 5. B/W Black and White
- 6. BNC Bayonet Neill Concelman connector
- 7. CAT5 Category 5 twisted pair Ethernet cable
- 8. CAT5E Category 5 Enhanced twisted pair Ethernet cable
- 9. CAT6 Category 6 twisted pair Ethernet cable
- 10. CBR Constant Bit Rate
- 11. CMOS Complementary Metal-Oxide Semiconductor image sensor
- 12. CVBR Constrained Variable Bit Rate

13. CCTV	Closed-Circuit Television (aka Video Surveillance)
14. DHCP	Dynamic Host Configuration Protocol
15. DNS	Domain Name System
16. DDNS	Dynamic Domain Name System
17. DOF	Depth of Field
18. EAP-TLS	Extensible Authentication Protocol Transport Layer Security
19. EAPoL	Extensible Authentication Protocol over LAN
20. FE	Fisheye
21. FOV	Field of View
22. FPS	Frames per Second (same as Images per Second)
23. FTP	File Transfer Protocol
24. GB	Giga Bytes
25. GbE	Gigabit Ethernet
26. H.264	MPEG-4 Part 10, Advanced video compression format standard
27. H.265	MPEG-H Part 2, HEVC video compression format standard
28. HD	High Definition
29. HEVC	High Efficient Video Coding
30. HTTP	Hypertext Transfer Protocol
31. HTTPS	Hypertext Transfer Protocol Secure
32. iAPI3	Illustra Application Programming Interface (version 3.x)
33. ICMP	Internet Control Message Protocol
34. ICR	Infrared Cut-filter Removal
35. IETF NTP	Internet Engineering Task Force for Network Time Protocol working group
36. IGMP	Internet Group Management Protocol

37. IK07 joules)	Impact Protection (07 = Impact Proof from 40 cm height and 2
38. IK10 joules)	Impact Protection (10 = Impact Proof from 40 cm height and 20
39. IntelliZip H.265	Illustra enhanced image and bandwidth compression for H.264 &
40. IP	Internet Protocol
41. IP66	Ingress Protection (66 = Dust-Tight and Low Water Pressure)
42. IP67 meter)	Ingress Protection (67 = Dust-Tight and Immersion up to 3 feet / 1
43. IPS	Images per Second (same as Frames per Second)
44. IPv4	Internet Protocol Version 4 (32-bit addresses)
45. IPv6	Internet Protocol Version 6 (128-bit addresses)
46. IR	Infrared
47. LAN	Local Area Network
48. LLDP	Link Layer Discovery Protocol
49. Mbps	Megabits per second (10 or 100 or 1,000)
50. MB	Mega Bytes
51. MD	Mini-Dome form-factor
52. mDNS	Multicast DNS
53. Micro SDXC	Onboard Storage Media Type
54. MJPEG	Motion JPEG video compression format standard
55. mm	Millimeter
56. nm	Nanometer
57. n/a	Not Applicable
58. NR	Noise Reduction
59. NTP	Network Time Protocol

60. NVT	Network Video Transmitter
61. ONVIF	Open Network Video Interface Forum
62. PEAP	Protected Extensible Authentication Protocol
63. PoE	Power over Ethernet standard
64. PoE+	Power over Ethernet Plus standard
65. PPPoE	Point-to-Point Protocol over Ethernet
66. PTZ	Pan-Tilt-Zoom optical functionality
67. QoS	Quality of Service
68. ROI	Region of Interest
69. RTCP	RTP Control Protocol
70. RTP	Real-Time Transport Protocol
71. RTSP	Real Time Streaming Protocol
72. SDN	Soft Day/Night
73. SFTP	Secure File Transfer Protocol
74. SMTP	Simple Mail Transfer Protocol
75. SNMP	Simple Network Management Protocol
76. SOAP	Simple Object Access Protocol
77. SSH	Secure Shell protocol
78. SSL	Secure Socket Layer encryption cryptographic protocol
79. TCP/IP	Transmission Control Protocol / Internet Protocol
80. TDN	True Day/Night
81. TLS	Transport Layer Security cryptographic protocol
82. UDP	User Datagram Protocol
83. UPnP	Universal Plus and Play
84. VBR	Variable Bit Rate

- 85. WAN Wide Area Network
- 86. WDR Wide Dynamic Range
- 87. WS Web Services Dynamic Discovery
- 88. Zeroconf Zero-configuration networking

B. Reference Standards

1. Safety Standards:

- a. UL 60950-1 – Information Technology Equipment
- b. EN 60950-1 – Information Technology Equipment
- c. CSA 22.2 No. 60950 – Information Technology Equipment
- d. IEC 60950-1 – Information Technology Equipment

2. Emissions Standards:

- a. FCC Part 15 Class A – Commercial or Industrial Use
- b. EN55032 Class A – Information Technology Equipment
- c. AS/NZS CISPR 32 Class A – Information Technology Equipment
- d. ICES-003/NMB-003 Class A – Information Technology Equipment

3. IEEE Standards:

- a. 802.1x Port-based Network Access Control provides authentication mechanism
- b. 802.3: Ethernet standard that specifies physical media and working characteristics of Ethernet.
- c. 802.3af: PoE (Power over Ethernet) standard that provides 12.95 watts (maximum 15.40 watts and 250 mA current) of electrical current over a complaint Ethernet cable (CAT5e or CAT6) as an alternative power source to 24VAC power input for operating the device.
- d. 802.3at: PoE+ (Power over Ethernet Plus) standard that provides 25.50 watts (maximum 30.00 watts and 600 mA current) of electrical current over a complaint Ethernet cable (CAT5e or CAT6) as an alternative power source to 24VAC power input for operating the device.

4. Immunity Standards:

- a. EN55024

b. EN50130-4

5. Environmental Standards:

a. UL-60950-22

b. IEC 60529

C. Definitions

1. Mini-Dome – A camera mounted inside of a transparent mini-dome enclosure that provides a horizontal FOV of 98-degree (Wide) and 35-degree (Telephoto), and vertical FOV of 71-degree (Wide) and 26-degree (Telephoto).

1.03 SUBMITTALS

A. Product Data

1. Manufacturer's printed or electronic data sheets
2. Manufacturer's installation and operation manuals
3. Manufacturer's release notes, application notes, and/or technical bulletins

1.04 QUALIFICATIONS

- A. Manufacturer shall be ISO 9001:2008 certified and a reputable Fortune 100 company with a minimum of 20 years' experience in manufacturing for in the security industry.
- B. Contractor shall provide a competent trainer who has extensive experience with the installed systems and in delivering training to provide the instruction. As an alternative, the Contractor may propose the use of factory training personnel for onsite Professional Services.

1.05 WARRANTY

- A. Manufacturer shall provide a limited 3 year warranty for the device to be free of defects in material and workmanship.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Manufacturer: Tyco Security Products

6 Technology Park Drive

Westford, MA 01886 USA

Phone: +1 978 577 4000

Email: VideoApps@tycoint.com

Web: www.illustracameras.com

B. Model: IFS03D1OCWT

C. Alternatives: None

2.02 DESCRIPTION

A. The network IP camera shall:

1. Built-in web server
2. Support multiple streams, up to 2065x1553 resolution
3. IR illumination effective to 25m
4. Progressive scan imager
5. Motorized varifocal lens
6. Onboard storage for local recording
7. IK10 and IP66/IP67 rated
8. Complies with ONVIF Profile S
9. Capable of integration with network recording systems which support iAPI3 or ONVIF Profiles S
10. Capable of operation as a standalone device on the network

B. Functions

1. Video Compression
 - a. H.265
 - b. H.265 IntelliZip
 - c. H.264 (default)
 - d. H.264 IntelliZip

- e. MJPEG
- 2. Standards: ONVIF Profile S
- 3. Web Browser access:
 - a. Microsoft Internet Explorer (V8 and higher)
 - b. Google Chrome
 - c. Mozilla Firefox
 - d. Apple Safari
- 4. Streaming methods for audio, video and metadata:
 - a. Unicast
 - b. Multicast
- 5. 3MP resolution camera shall support up to 3 streams with the following resolution options with maximum fps dependent on resolution:
 - a. Stream 1
 - 1) H.265, H.265 IntelliZip, H.264, H.264 IntelliZip
 - a) Maximum of 30 ips @ 2048x1536 with/without True WDR
 - b) Maximum of 60 ips @ 1920x1080
 - 2) MJPEG
 - a) Maximum of 30 ips @ 1920x1080 with/without True WDR
 - b) Maximum of 60 ips @ 1920x1080
 - b. Stream 2
 - 1) H.265, H.265 IntelliZip, H.264, H.264 IntelliZip
 - a) Maximum of 30 ips @ 1280x720 with/without True WDR
 - b) Maximum of 15 ips @ 1280x720
 - 2) MJPEG
 - a) Maximum of 30 ips @ 1280x720 with/without True WDR
 - b) Maximum of 15 ips @ 1280x720

c. Stream 3

1) MJPEG

a) Maximum of 15 ips @ 640x360 with/without True WDR

b) Maximum of 15 ips @ 640x360

d. Maximum Streams: 5 Concurrent streams of any combination

C. Cyber Security and Authentication:

1. Enhanced Security:

a. One-Click Security Hardening

b. Certificate Management

c. Disabling Unused Protocols

d. User Access Log for Cyber Audit Trail

e. Validate Complex Credentials

2. IEEE 802.1x:

a. EAP-TLS – RFC 5216

b. EAPoL – RFC3748 & RFC5247

c. PEAP

3. HTTPS Encryption (HTTP over TLS) – RFC2818

4. IP Address Filtering

5. Multi-Level Password Protection

6. TLS – RFC5246 v1.2

7. WS-Security

D. Camera Characteristics:

1. Onboard Storage: (Not Included)

a. Type: Micro SDXC Card

b. Speed: Class 10 or higher

- c. Capacity: Maximum of 128 GB
- 2. Memory:
 - a. ROM/Flash: 256 MB
 - b. RAM: 512 MB
- 3. Video Codec Settings:
 - a. H.265 and H.265 IntelliZip
 - 1) High Profile
 - 2) GOP Range: 1 to 150 (default 30)
 - 3) Bit Rate Methods: CBR, VBR, CVBR (default CVBR)
 - 4) VBR Quality: Lowest, Low, Medium, High, Highest (default High)
 - 5) CBR Bit Rates: 16 to 10,000 (default 1,000)
 - 6) CVBR Settings: Maximum bit rate (default 8,000)
 - b. H.264 and H.264 IntelliZip
 - 1) High Profile
 - 2) GOP Range: 1 to 150 (default 30)
 - 3) Bit Rate Methods: CBR, VBR, CVBR (default CVBR)
 - 4) VBR Quality: Lowest, Low, Medium, High, Highest (default High)
 - 5) CBR Bit Rates: 16 to 10,000 (default 1,000)
 - 6) CVBR Settings: Maximum bit rate (default 8,000)
 - c. MJPEG
 - 1) Quality: 1 to 100 (default 50)
- 4. Audio Settings:
 - a. Standard: G.711 a-law and u-law
 - b. Sampling Rate: 8 Khz
 - c. Sampling Rate: 16 bit

- d. Frequency Response Range: 100 to 3,600 Hz
- e. Inputs:
 - 1) Connector Type: Terminal Block
 - 2) Impedance: 20K ohms/attenuation = 0 dB
 - 3) Maximum level: 2V_{p-p}
- f. Outputs:
 - 1) Connector Type: Terminal Block
 - 2) Impedance: High
 - 3) Maximum level: 2V_{p-p}
- 5. Blur Detection
- 6. Imager: 1/2.8" CMOS progressive
- 7. Illuminator:
 - a. Smart IR
 - b. Adaptive IR
 - c. IR Distance: 25 m
 - d. Wavelength: 850 nm
- 8. Lens:
 - a. Format: 1/2.7"
 - b. Design: 1 Aspheric glass lens
 - c. Mount: Phi 14mm
 - d. Focal Distance: Integrated 2.8-12 mm Varifocal Megapixel Lens
 - e. Aperture Range: F/1.4 (Wide) ~ F/2.7 (Telephoto)
 - f. Focus Type:
 - 1) One-Touch Motorized Focus
 - 2) Motorized Varifocal

- 3) Lens Calibration
- g. Iris Type: P-Iris
- h. IR Correction: Optical Corrective
- i. Day/Night: True D/N with ICR
- j. View Angles:
 - 1) Horizontal: 98° (Wide) and 35° (Telephoto)
 - 2) Vertical: 71° (Wide) and 26° (Telephoto)
- k. Rotations:
 - 1) Pan Range: 375° (Prevents non-viewable angles)
 - 2) Tilt Range: 75°
 - 3) Z-Axis Rotation: 356°
- 9. Video Imaging
 - a. AEC Weighting Methods:
 - 1) Full Picture
 - 2) Upper
 - 3) Lower
 - 4) Centre Weighted
 - 5) Spot
 - 6) Left
 - 7) Right
 - b. Shutter Speed
 - 1) 1/10,000 to 1/8 sec
 - c. Exposure:
 - 1) Mode: Auto or Manual
 - 2) Compensation Offset Range: -2 to +2 F-Stops (default 0)

- 3) Minimum Exposure: 1/10,000 sec (default)
- 4) Maximum Exposure: 1/8 sec (default)
- 5) Frequency: 50Hz or 60Hz (default 60 Hz)
- 6) Flicker less Mode: Enable or Disable (default Disabled)
- d. White Balance:
 - 1) Auto Normal
 - 2) Manual
 - 3) Auto Wide
- e. Wide Dynamic Range Methods:
 - 1) True WDR with ICR
 - 2) Digital WDR with ICR
- f. Dynamic Range: 120 dB per imager information
- g. Noise Reduction:
 - 1) 2D DNR Low Pass Filter
 - 2) 3D DNR Adjacent Frame Filter
- h. Flicker Loss: 50/60 Hz or None
- i. Minimum Illumination:
 - 1) Color: 0.03 Lux
 - 2) B/W: 0.001 Lux
- 10. Motion Detection: 3 ROI Polygon Zones and Alarms
- 11. Privacy Zones: 9 Rectangular Zones
- 12. ROI High Compression Quality Zones:
 - a. 5 Rectangular Zones
 - b. Allows Bandwidth Optimization
- 13. Event Alarms:

a. Triggers:

- 1) Alarm Input: Max 6V (High) and 0.6V (Low)
- 2) Blur Detection
- 3) Motion Detection
- 4) Network Loss
- 5) Temperature

b. Actions:

- 1) Audio Clip Playback
- 2) Auxiliary Output: Relay 30V (Peak AC) / 1A
- 3) CIFS
- 4) FTP file transfer
- 5) Pre-alarm recording: 10 sec.
- 6) SD card storage
- 7) SMTP email file transfer

14. I/O Interfaces:

- a. Alarm Input/Output: 1
- b. Audio Input/Output: 1
- c. Video Output: 1 BNC
- d. Reset/Reboot: 1 Recessed Push Button
- e. Return to Factory Default Settings: 1 Recessed Push Button

15. Menu Languages:

- a. English (US) (Default)

16. User Accounts:

- a. Administrator
- b. Operator

c. Various User Levels

17. Text Overlay:

- a. Camera Name
- b. Date Time
- c. User Defined Text (4 position options)

E. Electrical Characteristics:

1. Input Voltage options:

- a. IEEE 802.3af Class 3 PoE RJ45 (Priority)
- b. 24VAC (-20% to +30%) Terminal block 2-pin 3.5 mm (47 to 63 Hz)

2. Power Draw:

- a. Current: 0.8 A
- b. Wattage: 12W
- c. In Rush Current: 32A p-p / 144us
- d. Surge Protection: 58V / 400W

F. Network Characteristics:

- 1. Ethernet interface: 10/100 Mbps Ethernet
- 2. Ethernet port: Single Copper RJ-45
- 3. Management
 - a. Remote configuration and management via web browser of the following:
 - 1) System Status
 - 2) IP Address Settings
 - 3) TLS Encryption
 - 4) Password Protected User Levels
 - 5) System Log
 - 6) Device Name

- 7) Firmware Upgrade
- b. Remote configuration and management via Illustra Connect of the following:
 - 1) Device Information (Device Name, Hostname, IP Address, Model Name, Product Code, Manufacturer, Firmware Version, Status, MAC Address)
 - 2) Discovery (IPv4, IPv6 or both; ONVIF, CGI IP Address or all 3)
 - 3) Snapshot
 - 4) Configure Network/Users/Date-Time (Single or Bulk)
 - 5) IP Address Settings
 - 6) Diagnostics
 - 7) Firmware Upgrade (Single or Bulk)
 - 8) Access Web Server
 - 9) Export Device List in CVS Format
 - 10) Device Management (Reset or Reboot)
4. Base Protocol: TCP/IP – RFC4614
5. Communication Protocol: IGMP
6. Discovery Methods:
 - a. mDNS Discovery Zeroconf
 - b. UPnP
 - c. WS-Discovery (ONVIF and Illustra Connect)
7. Email:
 - a. SMTP – RFC5321
 - b. Authenticated SMTP – RFC4954
8. External Interface Protocol:
 - a. iAPI3 v3.4
 - b. ONVIF Profile S
 - c. SOAP

- d. WS-Addressing
- e. WS-Eventing
- 9. File Transfer:
 - c. FTP
 - d. SFTP
- 10. Network Address Configurations:
 - a. DHCP – RFC2131
 - b. IPv4 – RFC791
 - c. IPv6 – RFC2460
 - d. LLDP
 - e. Static IP
 - f. Zeroconf – RFC3927
 - g. Illustra Connect Utility
- 11. Network Layer: ICMP
- 12. Network Management: SNMP v2c / v3
- 13. Network Name Resolution:
 - a. DNS – RFC5395
 - b. DDNS – RFC2136
- 14. Streaming Methods:
 - a. RTP – RFC3550
 - b. RTCP – RFC3550
 - c. RTSP – RFC2326
 - d. Unicast
 - e. Multicast – RFC1112 Level 1
- 15. Time Synchronization:

- a. NTP – RFC1305
- b. Poll Rate: 1 per minute

16. Transport Layers:

- a. TCP – RFC973
- b. UDP – RFC768

G. Diagnostic Indicators

1. Network

- a. Green LED: Ethernet Link
- b. Yellow LED: Network Activity

H. Physical:

- 1. Dimensions (WxD): 123 mm x 107 mm (4.84 in x 4.21 in)
- 2. Weight: Approximately 0.97 kg (2.14 lbs)
- 3. Shipping Weight: Approximately 1.07 kg (2.36 lbs)
- 4. Vandal Rating: IK10
- 5. Environment Rating: IP66 / IP67
- 6. Installation Type: Outdoor
- 7. Color: White
- 8. Bubble: Clear
- 9. Lens Cover:
 - a. Transmittance: 88%
 - b. Material Type: Polycarbonate
- 10. Materials:
 - a. Housing: Aluminum Alloy
 - b. Bubble Trim Ring: Aluminum, ADC12
 - c. Other Parts: Polycarbonate

I. Environmental:

1. Cold Start Temperature: -40° C to 50° C (-40° F to 122° F)
2. Operating Temperature: -50° C to 50° C (-58° F to 122° F)
3. Storage Temperature: -20° C to 60° C (-4° F to 140° F)
4. Relative Humidity: 10% to 90% (non-condensing)

2.03 ACCESSORIES

A. Documentation:

1. Installation Guide
2. Quick Start Guide
3. Regulatory
4. Template

B. Hardware:

1. Tool: Pin Torx 10 Security L-Key
2. Mounting Screws: 3 Plastic Anchors with 18mm Screws
3. Adapter Plate: 3 with 7mm screws and 8mm pendant cap screws
4. Desiccant

C. Mounting Adapter Types:

1. Mounting Plate (Included)
2. Pendant Cap (Optional)
 - a. Model Number: ADCi6DPCAPIW
 - b. Description: Pendant Cap for Flex Mini-Domes (custom color selected by architect)
3. Gooseneck Arm (Optional when used with Pendant Cap)
 - a. Model Number: ADLOMARM
 - b. Description: Gooseneck Arm (custom color selected by architect)

4. Outside Corner Mount Adaptors (Optional when used with Gooseneck Arm & Pendant Cap)
 - a. Model Number: ADCDMCRNRO
 - b. Description: Outside Corner Mount Adaptor (custom color selected by architect)
5. Pole Mount Adaptors (Optional when used with Gooseneck Arm & Pendant Cap)
 - a. Model Number: ADCDMPOLE
 - b. Description: Pole Mount Adaptor (custom color selected by architect)
6. Recessed Mount (Optional)
 - a. Model Number: IFDRECMNT
 - b. Description: Recessed Mount for Flex Mini-Domes

PART 3 EXECUTION

3.01 INSTALLERS

- A. Contractor shall comply with all applicable state and local licensing requirements.
- B. Contractor shall demonstrate network and CCTV knowledge to the satisfaction of the Owner's representative.

3.02 EXAMINATION

- A. Submission of a proposal confirms that the contract documents and site conditions are accepted without qualifications unless exceptions are specifically noted.
- B. The site shall be visited on a regular basis to appraise ongoing progress of other trades and contractors, make allowances for all ongoing work, and coordinate the requirements of this contract in a timely manner.
- C. Inspect systems before installation for cosmetic defects or damage.

3.03 PREPARATION

- A. Prior to installation, the camera device and network shall be configured and tested to meet the specified requirements in accordance with the manufacturer's instructions.

3.04 INSTALLATION

- A. Contractor shall follow all Manufacturer's published installation guidelines for installing, programming and testing of the camera.
- B. In order to ensure a complete, functional camera, for bidding purposes, where information is not available from the Owner upon request, the worst-case condition shall be assumed.
- C. Camera placement, pointing position, and configurations shall be coordinated with the Owner's representative, where appropriate.
- D. All necessary back boxes, racks, connectors, supports, conduit, cable, and wire must be furnished and installed to provide a complete and reliable camera installation. Exact location of all boxes, conduit, and wiring runs shall be presented to the Owner for approval in advance of any installation.
- E. All conduit, cable, and wire shall be installed parallel and square with building lines, including raised floor areas. Conduit fill shall not exceed forty percent (40%). All wires shall be gathered and tied up to create an orderly installation.
- F. The vandal-resistant network IP camera shall be installed within an indoor or outdoor environment and ceiling or wall mounted methods using provided or optional mounting accessory.
- G. Contractor ensures that the installed product contains the latest revision of Manufacturer's firmware.
- H. When the camera is part of a larger security system, the camera vendor must also be able to offer Professional Services that would deploy trained personnel to assist with the installation and programming of the camera.

3.05 TESTING AND CERTIFICATION

- A. Contractor shall demonstrate the functionality of the camera upon completion of installation, documenting the result of all tests and providing these results to the Owner.
- B. Contractor shall provide the necessary blank forms with instructions to fill in all the required data information that shall make up the information for the installed camera devices (location, installation position, make, model, IP address, username, password, image settings).

- C. Upon satisfactory on line operation of the camera devices, the entire installation including all subsystems shall be inspected. Contractor shall perform all tests, furnish all test equipment and consumable supplies necessary and perform any work as required to establish performance levels for the system in accordance with the specifications. Each device shall be tested as a working component of the completed system. All system controls shall be inspected for proper operation and response.
- D. Tests shall demonstrate the response time and display format of each different type of input sensor and output control device. Response time shall be measured with the system functioning at full capacity. Computer operation shall be tested with the complete data file.
- E. Contractor shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built documentation along with a letter of certification to indicate that the tests have been performed, and all devices are operational.
- F. The system test shall be witnessed by the Authority Having Jurisdiction. Any deficiencies noted during the testing must be corrected.
- G. A letter of certification shall be provided to indicate that the tests have been performed, and all devices are operational.
- H. The Owner's representative shall accept the system.

3.06 MAINTENANCE

- A. Preventative Maintenance Agreement during Warranty: As a separate price item, the Contractor shall provide preventative maintenance during the warranty period. Maintenance shall include, but not be limited to:
 - 1. Labor and materials, at no additional cost, to troubleshoot the camera devices.
 - 2. Labor and materials, at no additional cost, to provide test and adjustments to the camera devices.
 - 3. Regular inspections
- B. Preventative Maintenance Agreement: As a separate price item, the Contractor shall provide a complete Maintenance Agreement for a period of 12 months after the conclusion of the warranty period. The Maintenance Agreement shall include, but not be limited to:
 - 1. Labor and materials, at no additional cost, to troubleshoot the camera devices.
 - 2. Camera devices.

3. Labor and materials, at no additional cost, to provide test and adjustments to the camera devices.
4. Regular inspections.

3.07 STORAGE

- A. The product shall be stored in an environment consistent within the Manufacturer's published environmental ratings.

3.08 ATTACHED TABLES

- A. Table 1: Resolutions when Stream 1 is 30 ips or less

Resolutions	Stream 1 (w/wo True WDR)	Stream 2 (w/wo True WDR)	Stream 3 (w/wo True WDR)
Codec:	H.265, H.265 Intellizip, H.264, H.264 Intellizip, MJPEG	H.265, H.265 Intellizip, H.264, H.264 Intellizip, MJPEG	MJPEG
2048x1536 (4:3) QXGA 3MP	1 to 30 ips *	n/a	n/a
1920x1080 (16:9) 1080p 2MP	1 to 30 ips	n/a	n/a
1664x936 (16:9) 1.6MP	1 to 30 ips	n/a	n/a
1280x720 (16:9) 720p .95MP	1 to 30 ips	1 to 30 ips	n/a
1024x576 (16:9) PAL+ .59MP	n/a	1 to 30 ips	n/a
640x360 (16:9) nHD .23MP	n/a	1 to 30 ips	15 ips
480x360 (4:3) 480 .17MP	n/a	1 to 30 ips	15 ips
384x288 (4:3) .11MP	n/a	1 to 30 ips	15 ips
	(Default = 30 ips)	(Default = 15 ips)	(Default = 15 ips)

* Excludes MJPEG

Table 1 – Support when Stream 1 is 30 ips or less

B. Table 2: Resolutions when Stream 1 is over 30 ips

Resolutions	Stream 1	Stream 2	Stream 3
Codec:	H.265, H.265 Intellizip, H.264, H.264 Intellizip, MJPEG	H.265, H.265 Intellizip, H.264, H.264 Intellizip, MJPEG	MJPEG
2048x1536 (4:3) QXGA 3MP	n/a	n/a	n/a
1920x1080 (16:9) 1080p 2MP	1 to 60 ips *	n/a	n/a
1664x936 (16:9) 1.6MP	1 to 60 ips *	n/a	n/a
1280x720 (16:9) 720p .95MP	1 to 60 ips *	1 to 15 ips	n/a
1024x576 (16:9) PAL+ .59MP	n/a	1 to 15 ips	n/a
640x360 (16:9) nHD .23MP	n/a	1 to 15 ips	15 ips
480x360 (4:3) 480 .17MP	n/a	1 to 15 ips	15 ips
384x288 (4:3) .11MP	n/a	1 to 15 ips	15 ips

** Maximum ips on Stream 1 MJPEG can only be achieved if both Stream 2 & 3 are using lower resolution and/or ips*

Table 2 – Limitations when Stream 1 is over 30 ips

C. Table 3: Shutter Speeds

Shutter Speeds			
1/10,000 sec	1/2,000 sec	1/400 sec	1/30 sec
1/8,000 sec	1/1,500 sec	1/250 sec	1/15 sec
1/5,000 sec	1/1,000 sec	1/200 sec	1/8 sec
1/4,000 sec	1/800 sec	1/120 sec	
1/2,500 sec	1/500 sec	1/60 sec	

Table 3 – Shutter Speeds

END OF SECTION 28 2113

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Temporary erosion- and sedimentation-control measures.

- B. Related Sections:

1. Section 01 5000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Section 01 7300 "Execution" for field engineering and surveying.

1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 2000 "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

- B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 2. Use only hand methods for grubbing within protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Stockpile surplus topsoil to allow for resspreading deeper topsoil.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 1000

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SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Preparing subgrades for slabs-on-grade walks, pavements, turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

- B. Related Sections:

1. Section 01 5000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Section 03 3000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section 31 1000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 32 9200 "Turfs and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
5. Section 32 9300 "Trees, Plants and Ground Cover" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Aggregate layer placed between the subgrade or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by Architect.
- C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth moving operations.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 01 5000 "Temporary Facilities and Controls," are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.

4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing

and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 01 5639 "Temporary Tree and Plant Protection."

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

- A. Notify Special Inspector when excavations have reached required subgrade.
- B. If Special Inspector determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 3000 "Cast-in-Place Concrete."

- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of subbase material , free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent within 1.5% of optimum moisture content.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent within 1.5% of optimum moisture content.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 33 4600 "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Place base course material over subbase course under hot-mix asphalt pavement.
 - 2. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 - 4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material and maximum lift thickness comply with requirements.
 - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000

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SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Curing compounds.
 - 4. Applied finish materials.
- D. Jointing Plan illustrating Contractor recommended location of all sawcuts and control joints.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications:
 - 1. Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
 - 2. Comply with ACI 330, "Guide for Design and Construction of Concrete Parking Lot" unless modified by requirements in the Contract Documents.
 - 3. Comply with ACI 325, "Design of Jointed Concrete Pavements for Streets and Local Roads" unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.

- c. Ready-mix concrete producer.
- d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.
- C. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.
- E. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

- F. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
- G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- J. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.
- K. Zinc Repair Material: ASTM A 780.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by

mass of cementitious material when steel reinforcement is called out in exterior installations.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene microfibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, $\frac{3}{4}$ inches long. Use Fiberstrand 150 or approved equal.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. Dry, delivered pre-wetted and soaked.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM 1752 Vinyl full depth, with joint sealant.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi, unless otherwise indicated on the drawings.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 3 inches, or up to 5 inches with the use of a water-reducing chemical admixture.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements and as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Proof rolling to be performed in presence of Architect or Construction Manager.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, Construction Manager, or Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain 2" minimum cover to reinforcement.

- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, or through locations of intended contraction or isolation joints, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated, or when construction joint will experience heavy truck traffic. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint. Dowels to be epoxy coated and sized per ACI 330.
- C. Isolation (expansion) Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of not more than 30 feet, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 6. Apply joint sealant / caulk.
 7. Doweled Joints: Install dowel bars and support assemblies at joints where indicated, or when construction joint will experience heavy truck traffic. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint. Dowels to be epoxy coated and sized per ACI 330.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. For thickness 5 inches or less construct contraction joints for a depth equal to at least one-third of the concrete thickness, for thickness greater than 5 inches construct contraction joints for a depth equal to at least one-quarter of the concrete thickness, as follows or match jointing of existing adjacent concrete pavement:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated, or when construction joint will experience heavy truck traffic. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint. Dowels to be epoxy coated and sized per ACI 330.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed if plastic shrinkage cracking is of concern.
- D. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

- E. Comply with ACI 301 and ASTM C94, requirements for measuring, mixing, transporting, and placing concrete.
- F. A one time add of water to concrete during delivery or at Project site is permitted but the water to cementitious material ratio must not be violated.
- G. Do not add water to fresh concrete after testing.
- H. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- I. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- O. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated prior to placement and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Cold-applied joint sealants.
- 2. Hot-applied joint sealants.
- 3. Joint-sealant backer materials.
- 4. Primers.

- B. Related Requirements:

- 1. Section 07 9200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.
 - 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. Crafcro Inc; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Pecora Corporation; 301 NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

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. Crafcro Inc; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Pecora Corporation; 300 SL.
- C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 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. Meadows, W.R., Inc; Pourthane NS.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I or Type II.
 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. Crafcro Inc; RoadSaver 201.
 - b. Right Pointe; JTS 3405 Parking Lot Sealant 007.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.

3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
1. Place joint sealants so they fully contact joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
1. Remove excess joint sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

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SECTION 32 9113 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Final grade topsoil for finish landscaping.

1.2 RELATED SECTIONS

- A. Section 31 2000 - Earth Moving.
- B. Section 32 9200 - Turf and Grasses.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Topsoil: Provide Topsoil as specified in Specification Section 31 2000 - Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that building and trench backfilling have been inspected.
- B. Verify that substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size.
- C. Scarify surface to depth of 6 inches (150 mm) where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Place topsoil in areas where seeding and planting is required to thickness as scheduled.

- B. Place topsoil during dry weather.
- C. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- D. Remove roots, weeds, rocks, and foreign material while spreading.
- E. Manually spread topsoil close to existing plant life and building to prevent damage.
- F. Lightly compact placed topsoil.
- G. Surplus imported subsoil and topsoil shall be removed from the Owner's property.
- H. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 TOLERANCES

- A. Top of Topsoil: Plus or minus ½ inch.

3.5 PROTECTION

- A. Protect landscaping and other features remaining as final work.
- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.6 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Lawn: 4 inches.
 - 2. Landscape Beds: 8 inches.

END OF SECTION 32 9113

SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seeding, optional Hydroseeding, mulching, and fertilizing.
- B. Sod, installation and fertilizing.
- C. Maintenance.

1.2 RELATED SECTIONS

- A. Section 31 2000 Earth Moving.
- B. Section 32 9113 Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.
- C. Section 32 9300 Trees, Plants, and Groundcover

1.3 REFERENCES

- A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.
- B. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS

- A. Submit under provisions of Specification Section 01 7700 Closeout Procedures.
- B. Maintenance Data: Submit maintenance instructions, recommended cutting methods and maximum grass height, types, application frequency, and recommended

coverage of fertilizer.

- C. Product Data: Submit seed vendors' certified statement for grass seed mixture required, stating botanical and common names, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- D. Certificate of Compliance: See Regulatory requirements.

1.6 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- C. Submit sod certification for grass species and location of sod source.
- D. Sod Producer: A Company specializing in sod production and harvesting with a minimum five years experience, and certified by the State of Ohio.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from Project Manager indicating approval of seed mixture.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver grass seed mixture in sealed containers. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration.
- D. Do not deliver more sod than can be laid within 24 hours.

1.9 MAINTENANCE SERVICE

- A. Provide lawn maintenance including, but not limited to watering, cutting, weeding, fertilizing, re-seeding areas that are not taking hold for all seeded areas for sixty (60) days after the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

- A. Seed Mixture: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.
- B. Seed mix required as follows:
 - 90% Turf-type Tall Fescue
 - 10% Kentucky Blue Grass

2.2 SOD

- A. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color and texture, strongly rooted and capable of vigorous growth and development when planted. Sod shall be the best quality, nursery grown, **Turf-type Tall Fescue**.

2.3 SOIL MATERIALS

- A. Topsoil: As specified in Specification Section 31 2000 Earth Moving.

2.4 ACCESSORIES

- A. Mulching Material: Wood cellulose fiber, free of growth or germination inhibiting ingredients.
- B. Fertilizer: FS O-F-241, recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis to the following proportions: Nitrogen 12 percent, phosphoric acid 12 percent, soluble potash 12 percent.
- C. Water: Clean, fresh, potable, and free of substances or matter which could inhibit vigorous growth of grass.
 - 1. Water will be provided to the Landscape Contractor at the building hose bibbs.
 - 2. The Landscape Contractor shall furnish all equipment and hose as required to properly water the seeded areas.

- D. Herbicide: Teflan or approved equal.
- E. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass. Water will be provided to the Landscape Contractor at the building hose bibbs. The Landscape Contractor shall furnish equipment and hose as needed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared topsoil base is ready to receive the work of this Specification Section.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil as per Specification Section 32 9113 Landscape Grading.

3.3 PLACING TOPSOIL

- A. Place topsoil as per Specification Section 32 9113 Landscape Grading.

3.4 FERTILIZING

- A. Apply fertilizer at a rate of 30 pounds per 1,000 square feet.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

- A. Apply seed at a rate of 6 lbs per 1,000 sq ft evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.

- C. Planting Season: As established by the Project Manager.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Roll seeded area with roller not exceeding 112 lbs.
- F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain mulch clear of shrubs and trees.
- G. Apply water with a fine spray immediately after each area has been mulched. Saturate the depth of the topsoil.

3.6 OPTIONAL HYDROSEEDING

- A. Apply seeded slurry with a hydraulic seeder at a rate of 6 lbs per 1000 sq ft evenly in two intersecting directions.
- B. Do not hydroseed areas in excess of that which can be mulched on the same day.
- C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain mulch clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to the depth of the topsoil.

3.7 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod within 24 hours after harvesting to prevent deterioration.
- C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- D. Lay smooth. Align with adjoining undisturbed grass areas.
- E. Place top elevation of sod 1/2 inch below adjoining paving or curbs.
- F. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
- G. Water sodded areas immediately after installation. Saturate sod to full depth of the topsoil.

- H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding 112 lbs.

3.8 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings from Government Property after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove minor depressions or irregularities.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately reseed areas which show bare spots.
- H. Protect seeded and sodded areas with warning signs during maintenance period.

3.9 SCHEDULE

- A. All project disturbed areas not scheduled to receive impervious materials, or plant bed areas shall receive grass seed or sod in the locations as noted on the drawings and in accordance with this Specification Section. Verify extent of work and seed or sod locations with Project Manager.

END OF SECTION 32 9200

SECTION 32 9300 - TREES, PLANTS, AND GROUND COVER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Preparation of subsoil and topsoil.
- B. Topsoil bedding.
- C. New trees, plants and ground cover.
- D. Mulch and fertilizer.
- E. Maintenance.
- F. Tree Pruning.

1.2 RELATED SECTIONS

- A. Section 31 2000 Earth Moving.
- B. Section 32 9113 Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.
- C. Section 32 9200 Turf and Grasses

1.3 REFERENCES

- A. ANSI Z60.1 - American Standard for Nursery Stock.
- B. NAA (National Arborist Association) - Pruning Standards for Shade Trees.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants and ground cover specified in this Section.

1.5 SUBMITTALS

- A. Section 01 3300 Submittal Procedures: Procedures for Submittals.
- B. Certificate of Inspection of Plant Material by State or Federal Authorities.
- C. Maintenance Data: Include pruning and trimming method; types, application frequency, and recommended coverage of fertilizer for all installed plants.
- D. Submit list of plant material sources.

1.6 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with minimum five years experience.
- B. Installer Qualifications: Company specializing in installing and planting the plants with minimum three years experience and approved by nursery.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
- D. Tree Pruning: NAA - Pruning Standards for Shade Trees.
- E. Maintenance Services: Performed by qualified installer.
- F. Plant Materials: Nursery grown trees and shrubs grown in a recognized nursery in accordance with good horticultural practice with healthy root systems developed by transplanting or root pruning. Provide only healthy, vigorous stock, free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1.7 SUBSTITUTIONS

- A. Do not make substitutions of tree and shrub materials. If required landscape material is not obtainable, submit proof of non-availability to Architect's representative or designated representative and a proposal for use of equivalent material.

1.8 INSPECTION

- A. The Architect's representative or designated representative may inspect trees and shrubs either at the place of growth or at site before planting for compliance with requirements for genus, species, variety, size and quality. Architect's representative or designated representative retains the right to inspect trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to

reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site and replace with new material.

1.9 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.
- C. Plant Materials: Certified by federal or state department of agriculture Described by ASTM Z60.1; free of disease or hazardous insects.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, name of manufacturer, and certification of conformance to State regulations.
- C. Protect and maintain plant materials until planted.
- D. Deliver plant life materials immediately prior to placement. Do not deliver more plant material than can be planted in one day. Keep plants moist.
- E. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread.
- F. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Architect's representative or designated representative, do not cut tree leaders, and remove only injured or dead branches from trees. Required shrub sizes indicated are size after pruning. Prune shrubs to retain natural character. *Any shrubs sheared into smooth regular shapes will be rejected.*

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant materials when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C); where soil is frozen or muddy.

- B. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

1.12 WARRANTY

- A. Provide one-year warranty.
- B. Warranty: Include coverage for one continuous growing season after all plant materials are installed; replace dead or unhealthy plants, or plants dead beyond normal pruning limits.
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.13 MAINTENANCE SERVICE

- A. Maintain plant life for sixty (60) days after Date of Substantial Completion.
- B. Maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of maintenance period.
- C. Maintenance to include:
 - 1. Cultivation and weeding plant beds and tree mulch rings.
 - 2. Applying herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
 - 3. Remedy damage from use of insecticides.
 - 4. Water sufficient to saturate root system.
 - 5. Pruning, including removal of dead or broken branches.
 - 6. Disease control.
 - 7. Replacement of mulch.
- D. Inspect plant life at a minimum of once per week. Perform maintenance promptly.

PART 2 - PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SIZE

- A. Provide trees and shrubs of the sizes indicated in plant list and in accordance with dimensional relationship requirements of ANSI Z60.1 for kind and shape of trees and shrubs required. Trees and shrubs of larger size than specified may be used if approved by the Architect's representative or designated representative. Size of roots or balls shall be increased proportionately.

2.3 MEASUREMENTS

- A. Measure trees and shrubs with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4 inches caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread dimensions: *do not measure from branch or root tip to tip.*

2.4 SOIL MATERIALS

- A. Provide topsoil that is fertile, friable, naturally loamy, surface soil; reasonably free of subsoil, clay lumps, brush, weeds, and other litter and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth. On-site soil may be used, if it is determined acceptable by the Architect's representative or designated representative.
- B. If on-site is not suitable, obtain topsoil from local sources or from areas having similar soil characteristics to that found at site of work. Obtain topsoil from naturally well-drained sites where topsoil is at least 4 inches deep; do not obtain from bogs or marshes.

2.5 SOIL AMENDMENT MATERIALS

- A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 11 percent, phosphoric acid 8 percent, soluble potash 4 percent.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

- E. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.

- 1. Water will be provided by the contractor at the nearest available source in the vicinity of the project. Contractor to furnish hose and other equipment.

2.6 MULCH MATERIALS

- A. Mulching Material: Mulch shall be fine grade of shredded hardwood bark, 'Paygro' or an approved equal. Mulch shall be free of foreign matter and wood particles over 6" in length or 2" in width.

2.7 ACCESSORIES

- A. Anti-desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss, of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

2.8 PLANT SOIL MIX

- A. A uniform mixture of 1 part sphagnum peat moss and 2 parts topsoil by volume, or as noted on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared subsoil is ready to receive work; coordinate with lawn work; install plant materials after lawn grading, but prior to seed or sod work. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- B. Saturate soil with water to test drainage.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil as per Specification Section 31 2000 Earth Work.
- B. Dig pits and beds 6 inches larger than plant root system.

3.3 PLACING TOPSOIL

- A. Place topsoil as per Specification Section 31 2000 Earth Work.

3.4 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

- A. Place plants for best appearance for review and final orientation by Architect's representative or designated representative.
- B. Space plants in beds as shown on drawings. Set minimum 3' from structures, pavement edges, buildings, face of curb or as noted on drawings.
- C. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove all twine, bags and roping from base of trunks. Remove top 1/3 of the wire from root balls having wire baskets. Remove all rot-proof burlap.
- D. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.6 TREE PRUNING

- A. Prune trees to NAA Class 1 - Fine Pruning.
- B. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

3.7 FIELD QUALITY CONTROL

- A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 MAINTENANCE

- A. Neatly trim plants where necessary removing dead or broken branches. Do not shear plants into smooth, regular shapes.
- B. Immediately remove clippings after trimming.
- C. Water to prevent soil from drying out.
 - 1. Water will be provided to the Landscape Contractor at the building hose bibbs.
 - 2. The Landscape Contractor shall furnish equipment and hose as needed.
- D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- E. Apply pesticides in accordance with manufacturer's instructions.

3.9 SCHEDULE - PLANT LIST

- A. Refer to schedule on Landscape Plan.

3.10 SITE RESTORATION

- A. Daily: At the end of each day, the grounds shall be cleaned of all landscape contractor-related refuse and debris.
- B. **Upon completion**:
 - All paved surfaces affected by planting operations will be swept and hosed off.
 - All plant beds shall be free of weeds.

END OF SECTION 32 9300

SECTION 33 1100 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes water-distribution piping and related components outside of the building for domestic, fire, and combined water service mains.

1.3 DEFINITIONS

- A. PE: Polyethylene plastic.
- B. PP: Polypropylene plastic.
- C. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- D. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. All work must be done in compliance with the local water jurisdiction having authority, the local building department, the governing fire department, and all applicable state and national codes. If local codes conflict with project specifications or project plans the contractor should contact the Construction Manager.

- B. Minimum working pressures: The following are minimum pressure requirements for piping and specialties:
 - 1. Domestic Water Service: 200 psi
 - 2. Fire Protection Water Service: 250 psi
- C. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- D. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- H. NSF Compliance:
 - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without Construction Manager's permission.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company.
- B. Coordinate water main installation with other utility work.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: Class 52 minimum, 250 psi minimum pressure rating, AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated. The interior of the pipe shall be cement-mortar lined and seal coated in accordance with AWWA C104. The exterior of all pipe shall receive wither coal tar or asphalt base coating a minimum of 1 mil thick.

1. Mechanical-Joint, Ductile-Iron Fittings: 250 psi minimum pressure rating, AWWA C110, ductile-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile-iron glands, rubber gaskets, and Core 10 Alloy Steel only bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: Class 52 minimum, 250 psi minimum pressure rating, AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. The interior of the pipe shall be cement-mortar lined and seal coated in accordance with AWWA C104. The exterior of all pipe shall receive wither coal tar or asphalt base coating a minimum of 1 mil thick.
1. Push-on-Joint, Ductile-Iron Fittings: 250 psi minimum pressure rating, AWWA C110, ductile-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.

2.2 GATE VALVES

A. AWWA, Gate Valves:

1. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
 - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig.
 - 3) End Connections: Push on or mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.

2.3 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering

"WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.4 CHECK VALVES

A. AWWA Check Valves:

1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - a. Standard: AWWA C508.
 - b. Pressure Rating: 250 psig.

2.5 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: 250 psig.
 - c. Bypass Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
2. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: 250 psig.

2.6 WATER METERS

- A. Water meters are to be per the requirements of the authority having jurisdiction.

2.7 BACKFLOW PREVENTERS

- A. Double-Check, Backflow-Prevention Assemblies:
 - 1. As required per the jurisdiction having authority.
- B. Double-Check, Detector-Assembly Backflow Preventers:
 - 1. As required per the jurisdiction having authority.

2.8 WATER METER BOXES

- A. As required per the jurisdiction having authority.
- B. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

2.9 CONCRETE VAULTS

- A. As required per the jurisdiction having authority.
- B. Description: Precast, reinforced-concrete vault.
 - 1. Drain: Provide a gravity drain line from the pit to a suitable open daylight drainage point or storm sewer; or provide a sump pump and appurtenances with associated piping to suitable outlet point.

2.10 FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants:
 - 1. As required per the jurisdiction having authority.
 - 2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant barrel shall have safety breakage feature above the ground line. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure so that the valve remains closed should the barrel be broken off.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: Minimum 250 psig.
 - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.

- e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. As required per the jurisdiction having authority.

PART 3 - EXECUTION

3.1 EARTHWORK

A. General:

1. Conduit Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type B Conduits.
2. Conduit Not Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type C Conduits.

B. Excavation For Utility Trenches:

1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit.
3. Excavate trench walls per ODOT Item 603.05 and geotechnical report as identified on the Drawings.
4. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

C. Utility Trench Backfill:

1. Place and compact bedding course as required by ODOT specifications Item 603.06 and geotechnical report. Type 2 bedding consists of structural backfill extending at least 3 inches (75 mm) for all ODOT Item 706 rigid pipe conduits and 6 inches (150 mm) for all other conduits below the bottom of the conduit for the full width of the trench. Extend the bedding up around the pipe for a depth of not less than 30 percent of the rise of the conduit. Shape the bedding to fit the conduit with recesses shaped to receive the bell of bell-and-spigot pipe. Leave the bedding below the middle one-third of the pipe span uncompacted. Compact the remaining bedding according to ODOT Item 603.11.
2. Use Type 2 bedding for Types A, B, C, and D conduits except for long span structures and for conduits that require Type 3 bedding.
3. Type 3 bedding consists of a natural foundation with recesses shaped to receive the bell of bell-and-spigot pipe. Scarify and loosen the middle one-third of the pipe span.

4. Use Type 3 bedding for Type C and Type D conduits of the following materials: ODOT Items 706.01, 706.02, or 706.03.
5. Structural backfill for ODOT Item 603 bedding and backfill shall consist of limestone, gravel, natural sand, sand manufactured from stone, or foundry sand. Provide Type I or Type II structural backfill per the requirements of ODOT Item 703.11
6. Non-structural backfill should consist of clean, inorganic soil free of any miscellaneous materials, cobbles, and boulders. The fill should be placed in uniform, thin lifts and carefully compacted to a unit dry weight equal to 100 percent in structure areas and at least 98 percent of the maximum dry weight below pavement areas. The moisture content of the fill should be maintained at -2 to +1 percent of the optimum moisture content as determined in the laboratory by the Standard Test Methods for Moisture-Density Relations of Soils (ASTM D 698). Fill should not be placed in a frozen condition or upon a frozen subgrade.
7. Place backfill to the limits described and according to the compaction requirements of ODOT Item 603.11. Place the backfill in the trench and embankment outside the trench uniformly on both sides of the conduit for all conduit installations.
 - a. Type A and B. Backfill Types A and B conduits except for long span structures as follows
 - 1) In a cut situation, place and compact structural backfill above the bedding for the full depth of the trench. Within the trench and more than 4 feet (1.2 m) above the top of the conduit, if the trench can accommodate compaction equipment, the Contractor may construct Item 203 Embankment. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - 2) In a fill situation, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and to a depth of 2 feet (0.6 m) above the top of the conduit. Construct the embankment outside the limits of the backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - b. Type C and D. Backfill Type C and D conduits as follows:
 - 1) In a cut situation, for plastic pipe, place and compact structural backfill above the bedding and to 12 inches (300 mm) over the top of the pipe. All other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - 2) In a fill situation, for plastic pipe, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and vertically to

the top of the conduit. Then place for a depth of 12 inches (300 mm) structural backfill over the top of the pipe equal to the trench width centered on the pipe center line. Construct the embankment outside the limits of the backfill. All other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.

8. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
9. All fill soils shall be placed in accordance with the article "Compaction of Soil Backfills and Fills" from the Earth Moving Specification Section 312000.
10. Coordinate backfilling with utilities testing.
11. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
12. Place and compact final backfill of satisfactory soil material to final subgrade.

3.2 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
 1. Make connections larger than NPS 2 with tapping machine in accordance with the jurisdiction having authority.
 2. Make connections NPS 2 and smaller with drilling machine in accordance with the jurisdiction having authority.
- B. Comply with NFPA 24 for fire-service-main piping installation.
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- D. Bury piping with depth of cover over top at least 48 inches below finish grade.
- E. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- F. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.3 ANCHORAGE INSTALLATION

- A. Anchorage, General: Only the following may be used for anchorages and restrained-joint types:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.4 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. MSS Valves: Install as component of connected piping system.
- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.5 DETECTOR-CHECK VALVE INSTALLATION

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.6 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written instructions.

3.7 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.8 WATER METER BOX INSTALLATION

- A. Install water meter boxes in paved areas flush with surface.
- B. Install water meter boxes in grass or earth areas with top 1 inch above surface.

3.9 CONCRETE VAULT INSTALLATION

- A. Install precast concrete vaults according to ASTM C 891.

3.10 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints and thrust blocks, and support in upright position.
- B. AWWA Fire Hydrants: Comply with AWWA M17.

3.11 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.

3.12 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve, or service clamp and corporation valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping if in place. Coordinate connection with plumber.
- C. Connect drainage piping from concrete vault drains to storm-drainage system swale or pipe.

3.13 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
 - 2. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the contractors expense.
- C. Prepare reports of testing activities.

3.14 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 1100

SECTION 33 3100 – SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Precast concrete manholes.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. PP: Polypropylene plastic.
- C. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Piping Pressure Rating: at least equal to system test pressure.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe.
 - 2. Cleanouts.
- B. Shop Drawings: For the following:
 - 1. Manholes: Include plans, sections, details, and frames and covers.
- C. Coordination Drawings: Show pipe sizes, and locations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

- D. Profile Drawings (as necessary): Show system piping in elevation view. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and locations of other utilities crossing system piping.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Construction Manager's permission.

PART 2 - PRODUCTS

2.1 ABS PIPE AND FITTINGS

- A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.
 - 1. NPS 3 to NPS 6: SDR 35.
 - 2. NPS 8 to NPS 12: SDR 42.
 - 3. Gaskets: ASTM F 477, elastomeric seals.

2.2 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with integral bell-and-spigot rubber gasketed joints per ASTM D 3212.
- B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, with integral bell-and-spigot rubber gasketed joints per ASTM D 3212.

2.3 CLEANOUTS

- A. PVC with cast iron adaptor: Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Include cast iron adaptor and threaded brass closure plug.

2.4 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Diameter: 48 inches minimum, unless otherwise indicated.
 - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 - 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 - 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 6. Joint Sealant: Precast manhole section joints shall be formed entirely of concrete employing a round, wedge shaped profile gasket, and when assembled shall be self centering and make a uniform watertight joint conforming to ASTM C 443. The joint shall also be sealed with a bituminous mastic joint sealing compound.
 - 7. Resilient Pipe Connectors: Sewer pipe to manhole connections on all sanitary sewers shall be flexible and watertight. Sewer pipe shall be sealed in the manhole section pipe openings with a resilient connector meeting the requirements of ASTM C 923. The connection may be any of the following types:
 - a. Rubber sleeve with stainless steel banding
 - b. Rubber gasket compression

Resilient connector shall be cast integrally into the wall of the manhole section at the time of manufacture, or, shall be installed by mechanical means in openings cut into manhole wall per ASTM C 923.

- 8. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; Ductile Iron; or Cast Aluminum. Steps shall be wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Steps shall be equally spaced. Whenever possible steps shall not be placed directly above manhole flow channel. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
- 9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
- 10. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to interior surfaces.
- 11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design

with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
Manhole Frames and Covers shall be heavy duty.

- a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

2.5 CONCRETE

- A. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: minimum fall of 0.10 foot across manhole.
 2. Benches: Concrete, sloped to drain into channel.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.6 MISCELLANEOUS MATERIALS

- A. Paint: SSPC-Paint 16.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General:
 1. Conduit Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type B Conduits.
 2. Conduit Not Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type C Conduits.
- B. Excavation For Utility Trenches:
 1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit.
3. Excavate trench walls per ODOT Item 603.05 and geotechnical report as identified on the Drawings.
4. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

C. Utility Trench Backfill:

1. Place and compact bedding course as required by ODOT specifications Item 603.06 and geotechnical report. Type 2 bedding consists of structural backfill extending at least 3 inches (75 mm) for all ODOT Item 706 rigid pipe conduits and 6 inches (150 mm) for all other conduits below the bottom of the conduit for the full width of the trench. Extend the bedding up around the pipe for a depth of not less than 30 percent of the rise of the conduit. Shape the bedding to fit the conduit with recesses shaped to receive the bell of bell-and-spigot pipe. Leave the bedding below the middle one-third of the pipe span uncompacted. Compact the remaining bedding according to ODOT Item 603.11.
2. Use Type 2 bedding for Types A, B, C, and D conduits except for long span structures and for conduits that require Type 3 bedding.
3. Type 3 bedding consists of a natural foundation with recesses shaped to receive the bell of bell-and-spigot pipe. Scarify and loosen the middle one-third of the pipe span.
4. Use Type 3 bedding for Type C and Type D conduits of the following materials: ODOT Items 706.01, 706.02, or 706.03.
5. Structural backfill for ODOT Item 603 bedding and backfill shall consist of limestone, gravel, natural sand, sand manufactured from stone, or foundry sand. Provide Type I or Type II structural backfill per the requirements of ODOT Item 703.11
6. Non-structural backfill should consist of clean, inorganic soil free of any miscellaneous materials, cobbles, and boulders. The fill should be placed in uniform, thin lifts and carefully compacted to a unit dry weight equal to 100 percent in structure areas and at least 98 percent of the maximum dry weight below pavement areas. The moisture content of the fill should be maintained at -2 to +1 percent of the optimum moisture content as determined in the laboratory by the Standard Test Methods for Moisture-Density Relations of Soils (ASTM D 698). Fill should not be placed in a frozen condition or upon a frozen subgrade.
7. Place backfill to the limits described and according to the compaction requirements of ODOT Item 603.11. Place the backfill in the trench and embankment outside the trench uniformly on both sides of the conduit for all conduit installations.
 - a. Type A and B. Backfill Types A and B conduits except for long span structures as follows:
 - 1) In a cut situation, place and compact structural backfill above the bedding for the full depth of the trench. Within the trench and more than 4 feet (1.2 m) above the top of the conduit, if the trench can accommodate compaction equipment, the Contractor may construct

Item 203 Embankment. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.

- 2) In a fill situation, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and to a depth of 2 feet (0.6 m) above the top of the conduit. Construct the embankment outside the limits of the backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.

b. Type C and D. Backfill Type C and D conduits as follows:

- 1) In a cut situation, for plastic pipe, place and compact structural backfill above the bedding and to 12 inches (300 mm) over the top of the pipe. All other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - 2) In a fill situation, for plastic pipe, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and vertically to the top of the conduit. Then place for a depth of 12 inches (300 mm) structural backfill over the top of the pipe equal to the trench width centered on the pipe center line. Construct the embankment outside the limits of the backfill. All other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
8. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
 9. All fill soils shall be placed in accordance with the article "Compaction of Soil Backfills and Fills" from the Earth Moving Specification Section 312000.
 10. Coordinate backfilling with utilities testing.
 11. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
 12. Place and compact final backfill of satisfactory soil material to final subgrade.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, contact Construction Manager.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
 - 2. Install piping with 36-inch minimum cover unless otherwise indicated.
 - 3. Install ABS sewer piping according to ASTM D 2321 except as modified by this section or as required by the jurisdiction having authority.
 - 4. Install PVC sewer piping according to ASTM D 2321 except as modified by this section or as required by the jurisdiction having authority.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

- A. Preparatory to making pipe joints, all joint surfaces shall be cleaned of all dirt, dust, and foreign matter and shall be dry, smooth, and free of imperfections before placing joining materials. Gaskets, lubricants, primers, adhesives, or other joining materials shall be used as recommended by the pipe or joint manufacturer's specifications. Generally, lubricants and primers and adhesives shall be placed on both the bell and spigot portions of the joint. The pipe shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of watertightness required. In the event that pipe previously laid is disturbed due to any cause, it shall be removed and relaid.
- B. Joints that show leakage will not be accepted. If after backfilling and inspection, any joints are found to be allowing groundwater to enter the sewer, such joints shall be sealed by the contractor at no cost to the owner.
- C. No fittings (except service wyes and repair couplings) shall be allowed in gravity sewers. Open ends of wyes shall be plugged or sealed until service laterals are installed.
- D. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join ABS sewer piping according to ASTM D 2321 except as modified by this section or as required by the jurisdiction having authority.

2. Join PVC sewer piping according to ASTM D 2321 except as modified by this section or as required by the jurisdiction having authority.
3. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use medium-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 2. Use heavy-duty, top-loading classification cleanouts in paved foot-traffic, vehicle-traffic, roads, and service areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in asphalt or concrete pavement with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to grease interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.8 PAINTING

- A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:
1. Precast Concrete Manholes: All interior.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.

- e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
 - B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice. If authorities having jurisdiction do not have published procedures, or if sewer does not fall under a jurisdiction, perform tests as follows:
 - 4. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - 5. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - C. Manholes: Perform hydraulic test according to ASTM C 969.
 - D. Leaks and loss in test pressure constitute defects that must be repaired.
 - E. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- 3.10 CLEANING
- A. Clean interior of piping of dirt and superfluous material.

END OF SECTION 33 3100

SECTION 33 4100 - STORM DRAINAGE

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. Pipe and fittings.
 - 2. Nonpressure transition couplings.
 - 3. Cleanouts.
 - 4. Drains.
 - 5. Encasement for piping.
 - 6. Manholes.
 - 7. Catch basins.
 - 8. Stormwater inlets.
 - 9. Stormwater detention structures.
 - 10. Pipe outlets.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 - 2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
- B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - 2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

- A. PVC Cellular-Core Piping:
 - 1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 - 2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.
- B. PVC Corrugated Sewer Piping:
 - 1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
 - 2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
 - 3. Gaskets: ASTM F 477, elastomeric seals.
- C. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

E. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 or T-2 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

F. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 150 PVC pipe with bell ends
3. Gaskets: ASTM F 477, elastomeric seals.

G. PVC Water-Service Piping:

1. Pipe: ASTM D 1785, Schedule 40 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 2466, Schedule 40 PVC, socket type.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets sealant joints with ASTM C 990, bitumen or butyl-rubber sealant.
2. Class III, unless otherwise indicated.

2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco Inc.
 - c. Logan Clay Pipe.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. NDS Inc.
 - f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
3. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Cascade Waterworks Mfg.
 - b. Dallas Specialty & Mfg. Co.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Fernco Inc.
 - b. Logan Clay Pipe.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Canplas LLC.
 - b. IPS Corporation.
 - c. NDS Inc.
 - d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.
2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 DRAINS

A. Cast-Iron Area Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
3. Top-Loading Classification(s): Medium and Heavy Duty.

2.7 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: High-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

2.8 MANHOLES

- A. Standard Precast Concrete Manholes:
 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches minimum unless otherwise indicated.
 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 9. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into

sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.9 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 2 percent through manhole.
 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.10 CATCH BASINS

- A. Standard Precast Concrete Catch Basins:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 6. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into

sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.

7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
 1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
 2. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
 3. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

2.11 STORMWATER INLETS

- A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.
- B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.
- C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.
- D. Frames and Grates: Heavy duty, according to utility standards.

2.12 STORMWATER DETENTION STRUCTURES

- A. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
 1. Ballast: Increase thickness of concrete as required to prevent flotation.
 2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.
 3. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into

sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of structure to finished grade is less than 60 inches.

- B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.13 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - 1. Average Size: NSSGA No. R-3, screen opening 2 inches.
 - 2. Average Size: NSSGA No. R-4, screen opening 3 inches.
 - 3. Average Size: NSSGA No. R-5, screen opening 5 inches.
- C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
- D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 36-inch minimum cover, or as shown.
 - 4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 6. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - 7. Install corrugated steel piping according to ASTM A 798/A 798M.
 - 8. Install corrugated aluminum piping according to ASTM B 788/B 788M.
 - 9. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 10. Install PE corrugated sewer piping according to ASTM D 2321.
 - 11. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
 - 12. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 13. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 14. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
 - 15. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
 - 16. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - 17. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
5. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
6. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
7. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
8. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
9. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
10. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
11. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
12. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
13. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
14. Join fiberglass sewer piping according to ASTM D 3839 for elastomeric-seal joints.
15. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 - 1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
 - 2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
 - 3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
 - 4. Use Extra-Heavy-Duty, top-loading classification drains in roads.
- B. Embed drains in 4-inch minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.

- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.9 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.10 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 1423 "Storm Drainage Piping Specialties."
- B. Connect force-main piping to building's storm drainage force mains specified in Section 22 1423 "Storm Drainage Piping Specialties." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Connect to sediment interceptors specified in Section 22 1319 "Sanitary Waste Piping Specialties."

- E. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - 2. Use pressure-type pipe couplings for force-main joints.

3.11 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 2000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 33 4100

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