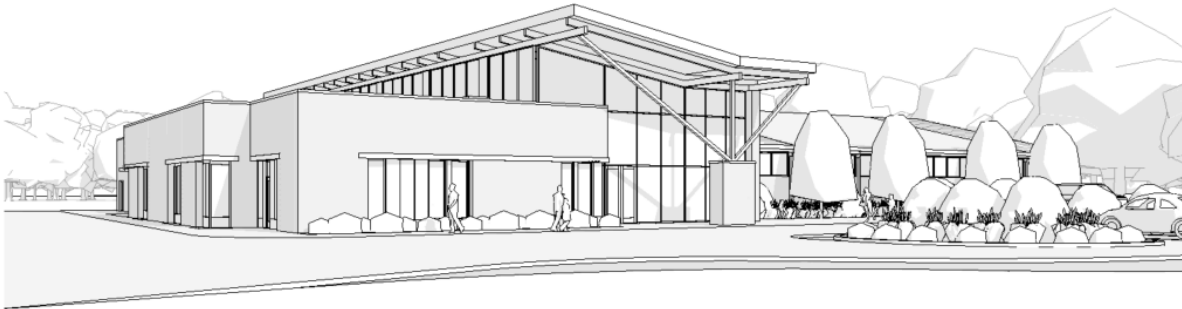


Century Community Shelter

Century, FL

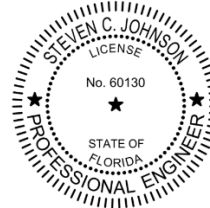
Bid Specifications



SS&L

Seay, Seay & Litchfield Architects
Pensacola, Florida

SS&L Job No. 26081



September 30, 2026

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**SECTION 010400
PROJECT COORDINATION AND CONSTRUCTION SEQUENCE CRITERIA**

1. GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.
- B. Florida Department of Transportation Standard Specifications for Roadway and Bridge Construction.
- C. Escambia County Technical Specifications.

1.02 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination.
 - 2. Administrative and supervisory personnel.
 - 3. General installation provisions.
 - 4. Cleaning and protection.
- B. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.03 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Work Progress and Coordination Meetings: The Contractor shall conduct weekly job progress and coordination meetings to provide a procedure for the contractors to coordinate all subcontractors. Attendance by all notified subcontractors is mandatory. The Architect and Owner's Representative shall be notified of and invited to all job progress meetings.
 - 5. Submittal Coordination Documentation: Each building system submittal including but not limited to structural, mechanical, plumbing, electrical, framing and finish systems shall indicate graphically coordination with other building systems. These documents shall be submitted to scale in hard copy and digitally in the latest release of AutoCad.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where 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 ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project Close-out activities.

- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.
- E. Construction Sequence Criteria – Within sixty days of notice to proceed using an established approved computer program specifically designed for preparation of construction project critical paths, the contractor shall submit a project critical path incorporating the following criteria:
 - 1. Contractor shall coordinate and cooperate with; security system installer/supplier, and furniture installer/suppliers. Installation of furnishings shall begin only after all work inside the building is substantially complete.
 - 2. Take measures to prevent paint over spray. Restrict paint applications to methods and conditions which limit over spray.

1.04 SUBMITTALS

- A. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- B. Project Superintendent: Contractor's project superintendent shall perform the normal administrative superintendent duties of overseeing the project.
- C. The Superintendent shall have a minimum of 5 years experience as the above described construction superintendent on similar projects of equal or larger dollar amount. A resume of the Superintendent's qualifications shall be submitted to the Owners Representative for approval 7 days after notice to proceed. The Owner shall have authority to disapprove the Contractor's submittal of such superintendent.
- D. Coordination shop drawings are required on several areas of the project.
 - 1. Within 30 calendar days of receipt of notice to proceed, each of the following contractors must submit to the contractor, their initial set of shop drawings for their work on the project:
 - a. HVAC
 - b. Plumbing
 - c. Fire Sprinkler
 - d. Electrical
 - e. Security, including communications
 - f. Structural Steel
 - 2. Upon initial review and approval, the contractor shall review an area by area walk through with a representative from each of the subcontractors listed in the above paragraph. Each representative must be authorized to make binding decisions for the contractor whom he represents. At each involved area, decisions will be made concerning installation of all MEP and security work in that particular area, including routing and installation of conduit, sprinkler lines, ductwork, placement of light fixtures, etc. so that all elevations of these systems do not conflict with each other or the existing structure or ceiling level. All conflicts in that area will be resolved prior to moving to the next area and all required changes will be marked on a master coordination set marked by the contractor, as well as on the individual trade shop drawings by each individual subcontractor's representative. Each trade subcontractor's shop drawings are to show the elevations above finish floor for their work (duct, pipe, etc.). The trade subcontractors will incorporate these notations and field requirements into their shop drawings and then transfer to disc. Each trade subcontractor will then send their disc to the HVAC subcontractor. The HVAC subcontractor will be responsible for gathering this information from all of the trades noted and overlaying each of the shop drawings on to one sheet for submission and review by

the contractor and Architect and his consultants. Work is not to proceed until these coordination shop drawings are approved. Please refer to section 01300 for other submittal requirements.

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision. All mounting heights to follow the requirements of the Americans with Disabilities Act.
- J. Special care will be required in the coordination and installation of systems in the reference room and mezzanine.

3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.
 - 4. Thermal shock.
 - 5. Excessively high or low humidity.
 - 6. Air contamination or pollution.
 - 7. Water or ice.
 - 8. Solvents.

9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation,
21. Improper lubrication,
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION 01040

**SECTION 011000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Century Community Shelter
 - 1. SS&L Project #26081
- B. The Owner's Name, hereinafter referred to as Owner:
Escambia County, FL; Escambia County Board of County Commissioners
221 Palafox Place, Suite 400
Pensacola, FL 32502
- C. Owner's Representatives:
 - 1. Escambia County Board of County Commissioners
Angela Jones - Senior Purchasing Coordinator
221 S Palafox St #400
Pensacola, FL 32502
Phone: (850) 595-4900
- D. Architect's Name: Seay, Seay, & Litchfield, PC. Architect's Job Number #26081
 - 1. Architect's Address:
 - a. 3 West Garden Street, suite 354, Pensacola, FL 32502
 - 2. Principal Architect : Raleigh Price, AIA, 334-791-5248 ext. 202, rprice@sslarch.com
 - 3. Project Manager: Brad Robinson, AIA , (662) 303-4438, brobinson@sslarch.com

1.02 CONTRACT DURATION

- A. Two hundred and forty (240) calendar days from notice to proceed to substantial completion, plus thirty (30) calendar days for punch list to be completed. The Owner may have the option to occupy the building upon substantial completion. The Contractor will be responsible for coordinating punch list activities around the Owner's activities if both are occurring at the same time.

1.03 PROJECT DESCRIPTION

- A. The following information is presented to assist the Bidder(s) with a more complete understanding of the project requirements and scope of work. This information shall be used as supplemental information and is in no way all-inclusive of the Contract requirements.
- B. Bidders shall thoroughly investigate the project site prior to bid. Bidders shall invest significant time to fully understand the scope of work required by the Contract Documents.
- C. The scope of work required by the Contract Documents includes, but is not limited to:
 - 1. Construction of a **New Community Shelter** as shown on the drawings and specifications, including, but not limited to, the following:
 - a. Renovation of the existing Gymnasium, as outlined in the drawings and specifications, includes exterior improvements to the existing CMU and brick masonry walls, new fenestration, and a new roofing system. Interior improvements include new floor, wall, and ceiling finishes along with gymnasium equipment, retractable seating, and associated building systems and infrastructure.
 - b. New construction as outlined in the drawings and specifications consists of an adjoining building addition utilizing primarily load-bearing CMU wall construction, with structural steel framing at the high-roof portion and low-slope roof assemblies throughout. Exterior construction includes brick masonry veneer, metal wall panels, storefront and curtain wall systems, and associated building envelope components. Interior spaces include a main lobby and central circulation corridor, multipurpose spaces, concessions, restrooms, and other supporting spaces, along with associated interior finishes, fixtures, equipment, and building systems and infrastructure.

- c. Site improvements include modifications to existing site circulation and parking areas, new sidewalks and pedestrian connections, grading and drainage improvements, site utilities, and landscaping.
2. Sitework and Demolition including:
 - a. Selective Demolition of specific existing Gymnasium building components, along with the removal of existing site pavement, sidewalks, and other components as indicated on the demolition drawings.
3. Owner Furnished Furniture, Furnishings and Equipment (FF&E):
 - a. Contractor's base bid shall include rough-ins for plumbing, mechanical, and electrical: including installation and final connection of all items indicated on the drawings as Owner Furnished Contractor Installed (OFCl).

1.04 SUPERVISORY PERSONNEL REQUIREMENTS

- A. General Contractor's Qualifications: The contractor should have completed a minimum of five (5) projects of similar complexity and delivery method within the past ten (10) years. Prior to contract award, the General Contractor shall provide documentation of projects upon request by the Architect for approval.
- B. Construction Superintendent:
 1. The Contractor shall assign an on-site project superintendent who is dedicated fulltime to the project.
 2. The construction superintendent must be a full-time employee of the General Contractor. Third-party construction superintendents will not be acceptable for the project.
 3. The construction superintendent must be on site at all times that any work is being performed by the General Contractor's personnel or any personnel from a subcontractor.
 4. The Contractor may assign additional on-site superintendents as deemed necessary for successful completion of the work.
 5. The construction superintendent shall have a minimum of ten years' experience serving as a construction superintendent on projects of similar size, scope, complexity and cost. Alternatively, the superintendent may have 5 years of experience as a construction superintendent on projects of similar size, scope, complexity and cost if the superintendent has a 4-year degree in Building Science or 4-year degree in Civil Engineering from an accredited university. Prior to construction the contractor shall submit a resume of the construction superintendent to the architect for approval.
- C. Construction Project Manager:
 1. In addition to the superintendent, the Contractor shall employ at least one off-site project manager assigned to the project.
 2. The Contractor's project manager must be a full-time employee of the General Contractor. Third-party project management will not be acceptable for the project.
 3. The Contractor shall provide a project manager with minimum of ten (10) years' experience serving as a project manager on projects of similar size, scope, complexity, and cost. Prior to construction, the Contractor shall submit a resume of the project manager to the architect for approval.
- D. Site Safety Manager
 1. In addition to the required construction superintendent and Site QC Manager, the General Contractor shall provide one or more Site Safety Managers.
 2. The role of site safety manager can be filled by the Construction Superintendent.
 - a. If the construction superintendent is intended to fill the role of Site Safety Manager, the required construction superintendent must meet the required OSHA credential below and shall serve as Site Safety Manager for the respective project scope.
 3. The individual fulfilling the Site Safety Manager responsibility must have completed required OSHA training and be a holder, in good standing, of a current OSHA 30-Hour Card.
 4. Prior to construction, the Contractor shall submit a copy of the Site Safety Manager's current OSHA 30-Hour Card to the architect for approval.

- E. Professional Roofing Consultant: The owner **may** engage the services of a Professional Roofing Consultant as specified in individual specification sections. The Contractor and the Roofing Sub-contractor shall cooperate with the roofing consultant, attend and participate in all roofing consultant related meetings and inspections, and correct all roofing deficiencies reported by the roofing consultant at no additional cost to the Owner.
- F. Comply with all Local, State, and Federal Regulatory Agencies, including but not limited to, the Following:
 - 1. City of Century, Florida
 - 2. Escambia County Board of Commissioners
 - 3. Florida Fire Marshall
 - 4. Florida Department of Environmental Management
 - 5. OSHA
 - 6. The Americans with Disabilities Act
 - 7. Applicable Federal Agencies
 - 8. Obtain copies of the regulations listed above which are required by Law to be at the project site and keep at the project site for the use of all parties.
- G. Conflicts in the Contract Documents: Where conflicts occur in the Contract Documents, the more stringent shall apply and be included in the Contractors bid, unless otherwise clarified in writing by the Architect and Owner's Representative.
- H. Documents and Samples at the Site
 - 1. "As Issued" Set
 - a. The Contractor shall maintain at the Project site, in good order, at least one copy of all Addenda, Change Orders, supplemental drawings, written directives and clarifications, and approved Submittals intact as issued, and an updated construction schedule.
 - 2. "Posted" Set
 - a. The Contractor shall maintain at the Project site, in good order, at least one set of the Drawings and Project Manual into which the Contractor has "posted"(incorporated) all Addenda, Change Orders, supplemental drawings, clarifications, and other information pertinent to the proper performance of the Work. The Contractor shall assure that all sets of the Drawings and Project Manuals being used by the Contractor, Subcontractors, and suppliers are "posted" with the current information to ensure that updated Contract Documents are used for performance of the Work.
 - 3. Record Set
 - a. One set of the Drawings and Project Manual shall be the Contractor's record set in which the Contractor shall record all field changes, corrections, selections, final locations, and other information as will be duplicated on the "As-built" documents required under this Section. The Contractor shall record such "as-built" information in its record set as it becomes available through progress of the Work. The Contractor's performance of this requirement shall be subject to confirmation by the Architect at any time as a prerequisite to approval of Progress Payments.
 - b. The documents and samples required by this Article to be maintained at the Project site shall be readily available to the Architect, Owner, Other Project Inspector, and their representatives.
- I. "As-Built" Documents
 - 1. Unless otherwise provided in the Contract Documents, the Contractor shall deliver two (2) sets of "As-built" documents, as described herein, to both the Architect and Owner's Representative for submission to the Owner upon completion of the Work. Each set of "As-built" documents shall consist of a copy of the Drawings and Project Manual, in like-new condition, into which the Contractor has neatly incorporated all Addenda, Change Orders, supplemental drawings, clarifications, field changes, corrections, selections, actual locations of underground utilities, and other information as required herein or specified elsewhere in the Contract Documents.

2. The Contractor shall use the following methods for incorporating information into the "As-built" documents:
 - a. Drawings
 - 1) To the greatest extent practicable, information shall be carefully drawn and lettered, in ink, on the Drawings in the form of sketches, details, plans, notes, and dimensions as required to provide a fully dimensioned record of the Work. When required for clarity, sketches, details, or partial plans shall be drawn on supplemental sheets and bound into the Drawings and referenced on the drawing being revised.
 - 2) Where a revised drawing has been furnished by the Architect, the drawing of latest date shall be bound into the Drawings in the place of the superseded drawing.
 - 3) Where a supplemental drawing has been furnished by the Architect, the supplemental drawing shall be bound into the Drawings in an appropriate location and referred to by notes added to the drawing being supplemented.
 - 4) Where the Architect has furnished details, partial plans, or lengthy notes of which it would be impractical for the Contractor to redraw or letter on a drawing, such information may be affixed to the appropriate drawing with transparent tape if space is available on the drawing.
 - 5) Any entry of information made in the Drawings that is the result of an Addendum or Change Order, shall identify the Addendum or Change Order from which it originated.
 - b. Project Manual
 - 1) A copy of all Addenda and Change Orders, excluding drawings thereof, shall be bound in the front of the Project Manual.
 - 2) Where a document, form, or entire specification section is revised, the latest issue shall be bound into the Project Manual in the place of the superseded issue.
 - 3) Where information within a specification section is revised, the deleted or revised information shall be drawn through in ink and an adjacent note added identifying the Addendum or Change Order containing the revised information.
 3. Within ten days after the Date of Substantial Completion of the Work, or the last completed portion of the Work, the Contractor shall submit the "As-built" documents to the Architect for approval. If the Architect requires that any corrections be made, the documents will be returned in a reasonable time for correction and resubmission.
- J. General Warranty
1. The Contractor warrants to the Owner and Architect that all materials and equipment furnished under the Contract will be of good quality and new, except such materials as may be expressly provided or allowed in the Contract Documents to be otherwise, and that none of the Work will be Defective Work.
- K. One-Year Warranty
1. If, within one year after the date of Substantial Completion of the Work or each designated portion of the Work (or otherwise as agreed upon in a mutually-executed Certificate of Substantial Completion), any of the Work is found to be Defective Work, the Contractor shall promptly upon receipt of written notice from the Owner or Architect, and without expense to either, replace or correct the Defective Work to conform to the requirements of the Contract Documents, and repair all damage to the site, the building and its contents which is the result of Defective Work or its replacement or correction.
 2. The one-year warranty for punch list items shall begin on the Date of Substantial Completion if they are completed or corrected within the time period allowed in the Certificate of Substantial Completion in which they are recorded. The one-year warranty for punch list items that are not completed or corrected within the time period allowed in the Certificate of Substantial Completion, and other Work performed after Substantial Completion, shall begin on the date of Final Acceptance of the Work. The Contractor's

- correction of Work pursuant to this warranty does not extend the period of the warranty. The Contractor's one-year warranty does not apply to defects or damages due to improper or insufficient maintenance, improper operation, or wear and tear during normal usage.
3. Upon recognizing a condition of Defective Work, the Owner shall promptly notify the Contractor of the condition. If the condition is causing damage to the building, its contents, equipment, or site, the Owner shall take reasonable actions to mitigate the damage or its continuation, if practical. If the Contractor fails to proceed promptly to comply with the terms of the warranty, or to provide the Owner with satisfactory written verification that positive action is in process, the Owner may have the Defective Work replaced or corrected and the Contractor and the Contractor's Surety shall be liable for all expense incurred.
 4. Year-end Inspection(s): An inspection of the Work, or each separately completed portion thereof, is required near the end of the Contractor's one-year warranty period(s). The subsequent delivery of the Architect's report of a Year-end Inspection will serve as confirmation that the Contractor was notified of Defective Work found within the warranty period.
 5. The Contractor's warranty of one year is in addition to, and not a limitation of, any other remedy stated herein or available to the Owner under applicable law.
- L. Permits, Fees and Notices
1. Unless otherwise provided in the Contract Documents, the Contractor shall be responsible for securing a Building Permit. The Contractor shall be responsible for securing and paying for all other required permits and governmental fees, business license, Contractor's Quarterly Report, and inspections necessary for proper execution and completion of the Work which are customarily secured after award of the Construction Contract and which are in effect on the date of receipt of bids.
 2. The Contractor shall be required to obtain and maintain the Florida Department of Environmental Protection (FDEP) NPDES construction stormwater permit.
 3. The Contractor shall comply with and give notices required by all laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.
- M. Taxes:
1. The Contractor and its Subcontractors shall have a City of Century Business License. For information, contact the City of Century.

1.05 PROJECT EQUIPMENT COORDINATION

- A. Prior to ordering specified equipment, it shall be the contractor's responsibility to ensure that all equipment can be fitted, placed and installed into its specified location. Coordination shall include, but is not limited to, the manufacturer's component size, proper clearances, assembly, critical path scheduling, and coordination of all other trades. If required, the contractor shall be responsible for all necessary demolition and associated reparations to accomplish full equipment installation.
- B. The contractor shall be responsible for all means, methods, sequencing of work, demolition, and reparations to the property and facilities as required to accomplish the work. This shall include but is not limited to the installation of all equipment, furnishings, and materials.

1.06 SUBCONTRACTOR REQUIREMENTS

- A. Project will be executed on a Bid Basis, awarding to a General Contractor. However, each trade contractor acknowledges that his work will include:
 1. Supervision.
 2. Scheduling
 3. Layout
 4. Coordination of its forces with those of other trade contractors
 5. Quality control
 6. Demolition as required (including complete or partial removal, chipping, leveling, grinding, drilling, bracing, shoring, etc.)

7. Repair of existing adjacent surfaces or conditions affected by demolition back to their previous undisturbed state.
8. Temporary facilities.
9. Cutting and patching.
10. Waste removal.
11. Cleaning.
12. Protection of existing and new work.
13. Safety program and procedures for contractor's work forces.

1.07 USE OF SITE AND MISC. REQUIREMENTS

- A. Work shall be conducted at specific times as required by the Owner. These times may require Phases of the work be conducted after hours and weekends for specific areas within the facility.
- B. The space available to the contractor for the performance of the work, either exclusively or in conjunction with others performing other construction as part of the project, is as per the owner's approval.
 1. Other areas are off limits to all construction personnel.
- C. Access to site will be limited; obtain owner's approval of proposed routes of access.
- D. Keep existing sidewalks, roads, parking lots and drives on site clear and available at all times. Promptly remove mud, dirt, debris etc. from sidewalks, streets and public right-of-way during construction as it occurs.
- E. Storage areas on site are very minimal and will be limited to materials that are to be immediately used in the progress of the work. If additional storage is required, the contractor shall secure and be responsible to pay for such off site storage in a fully bonded and insured facility acceptable to the owner, with all items clearly identified as being assigned to this project.
- F. Contractors and Vendors are to lock all vehicles when parked and unattended. Do not leave keys in vehicles or equipment when unattended or leave unattended with motor running.
- G. The Owner, Representative, Architect and the Architect's consultants as well as Building Authorities will require vehicular site accessibility on a regular basis to conduct business related to the project including performing inspections, observations, etc. The Contractor will maintain reasonable accessible routes for foot traffic through the site.
- H. Provide secure temporary barricades, fencing, etc. as indicated to separate the public from construction operations. Compliant safety and/or warning signage is to be provided as well in conjunction with fencing and barricades.
- I. Construction operations are not to affect any of the ongoing operations of the Owner throughout the site. Construction equipment is not to be attached to, or swing over existing buildings to remain, public areas, occupied buildings or parking lots, right-of-ways, etc.
- J. Smoking or other use of other types of tobacco products shall not be permitted on any property. Comply with all applicable governing authorities.
- K. The use or presence of alcohol and/or debilitating substances are strictly prohibited on the project site.
- L. Comply with the owner's security requirements and all applicable laws.
- M. Signs: Provide signs adequate to direct visitors.
 1. Do not install, or allow to be installed, signs other than specified Project sign(s) and signs identifying only the principal Trade Contractors involved in the project. Location of signs to be determined by General Contractor per the approval of the Owner's representative.
- N. Extreme care shall be taken to protect the site amenities that are shown to remain. These elements shall be roped off and have no driving or parking or any other construction activities under the tree canopy.
- O. Music Devices: No music devices will be permitted on site to include but not limited to radios, tape players, CD players, and head phones.

1.08 OWNER'S RESPONSIBILITIES

- A. Owner's Representative
 - 1. The Owner's Representative will manage the Work of the project and be the point of contact for all communications on behalf of the owner. The Owner's Representative will also coordinate all administrative and procedural requirements.
- B. Items noted NIC (Not in Contract) or OFOI (Owner Furnished, Owner Installed) will be supplied and installed by Owner.
- C. Items noted OFCI will be supplied by Owner and shall be installed by the Contractor.
- D. Owner Occupancy
 - 1. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- E. Contractor Use of Site and Premises
 - 1. Construction Operations: Limited to the affected scope of work shown on the drawings. Coordinate with Owner.
 - 2. Provide access to and from site as required by law and by Owner:
 - a. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - b. Do not obstruct roadways, sidewalks, or other public ways without permit.
 - 3. Utility Outages and Shutdown:
 - a. Limit disruption of utility services to hours the building is unoccupied. Provide 72 hour notice (during business day hours) to the Owner regarding any outage of electrical service or telephone service in any area of the facility.
 - b. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - c. Prevent accidental disruption of utility services to other facilities.
- F. Work Sequence
 - 1. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 012200
UNIT PRICE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 COSTS INCLUDED

- A. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
- B. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- C. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- D. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.
- E. Under the provisions stated in the General Conditions of the Contract, the Owner reserves the right to negotiate a lower rate at the time of use of a unit price to implement work defined or required under the unit price provisions.
- F. The following items of work are anticipated during the performance of this contract; however the exact quantity of each work item may not be determinable prior to bidding. The Contractor shall therefore, include in his Lump Sum Base Bid, an allowance for the following items in the quantities indicated: Allowance Unit Prices include all charges for labor, materials and equipment, shoring, layout, supervision (field and home office), general expenses, insurance, overhead and profit, but not limited to, for the accomplishment of the Allowance item(s). Where quantities of same items of work are defined and are quantified in the bid documents, the allowance quantities indicated hereinafter shall be in addition to those that are indicated. (Example: If the site grading plan indicated new and existing grades, the bidder shall compute the quantity of earthwork required and include that quantity of work in the bid the same as if no "allowance" quantity were specified. If an additional allowance quantity of earthwork is stipulated that stipulated allowance quantity of work shall also be included in addition to the quantity computed from the bidders earthwork "takeoff").
- G. The following Unit Prices Quoted are for increases or decreases in the above quantities included in the Lump Sum Base Bid. These Unit Prices include all charges for labor, materials and equipment, shoring, layout, supervision (field and home office), general expenses, insurance, overhead and profit, but not limited to, for the accomplishment of the Allowance item(s).
- H. Clarification Note: The Unit Prices quoted by the Contractor shall apply to increases (additive change orders) and to decreases (deductive change orders). This requirement shall supplement the requirements of the General Conditions and Instructions to Bidders. Changes in the contract amount that are computed using the Stated Allowances and Unit Prices shall be figured at the same unit price whether additive or deductive.

1.03 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

- A. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.
- B. Assist by providing necessary equipment, workers, and survey personnel as required.
- C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and will have this Work measured by the Owner's geotechnical consultant, owner's civil engineer, or owner's other representatives as appropriate to trade.

1.05 UNIT PRICE LIST

- 1. **Removal of Unsuitable Material and Replacement with Engineered Fill:** Cost per Cubic Yard.
- 2. **4" Thick Concrete Pavement:** Cost per Square Yard.
- 3. **Additional Tonnage of Steel Structural Components:** Cost per Ton.
- 4. **Asphalt Pavement:** Cost per Square Yard.
- 5. **Tuckpointing of Masonry Walls:** Cost per Square Foot.
- 6. **Removal and Replacement of existing Tectum Roof Decking at Gymnasium Roof:** Cost per Square Foot
- 7. **Removal and Replacement of existing Wood Blocking at Gymnasium Roof:** Cost per Board Foot

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 012300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

- A. Contractor's bid Proposal Form
- B. General Conditions of the Contract
- C. Section 01 1000 Summary

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

ALTERNATES

- A. **Alternate No. 1 - Telescopic Seating** - Provide all manufacturing, construction, labor, and materials required for the North Side Gymnasium Telescopic Seating, as shown on the Drawings and specified in Section 11 6600 – Telescopic Seating.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 012500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures, coordination.
- B. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- C. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.04 REFERENCE STANDARDS

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
- B. Substitution Request -County Standard Form Exhibit F.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated the product and determines that it demonstrates equal performance, dimensions, warranty, electrical characteristics, wind ratings, Florida approvals where applicable, and responsibility for downstream redesign or coordination cost.
 - 2. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 3. Agrees to provide the same warranty for the substitution as for the specified product.
 - 4. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 5. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 6. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 7. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
 - 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
 - 2. Architect will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids. The Time (days) will be determined by purchasing.
- B. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Substitutions after the award of Contract are considered a Change Order and must be completed using County Standard Form Exhibit F.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

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

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION

**SECTION 013000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Contractor's daily reports.
- G. Progress photographs.
- H. Submittals for review, information, and project closeout.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

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

The use of alternative submittal services, (emailed PDFs, Procore, etc.) will be considered on a case-by-case basis.

- C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Subcontractor's
 - 5. Owner's Representative
 - 6. Construction Engineering and Inspections Manager
- B. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Designation of personnel representing the parties to Contract, Owner and <1|A/E|>.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
 - 8. Scheduling activities of a Geotechnical Engineer.
 - 9. Owner's work
- C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Contractor will schedule meeting at the Project site prior to Contractor occupancy.
 - 1. Site Mobilization meeting shall be conducted by the Owner's Representative and Construction Engineering and Inspections Manager.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Owner's Representative
 - 4. Construction Engineering and Inspections Manager
 - 5. Architect.
 - 6. Contractor's superintendent.
 - 7. Subcontractors.
- C. Agenda:
 - 1. Use of premises by Owner and Contractor.
 - 2. Owner's requirements.
 - 3. Construction facilities and controls provided by Owner.
 - 4. Temporary utilities provided by Owner.
 - 5. Survey and building layout.
 - 6. Security and housekeeping procedures.
 - 7. Schedules.
 - 8. Application for payment procedures.

9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- D. Attendance Required:
1. Contractor.
 2. Owner.
 3. Owner's Representative
 4. Construction Engineering and Inspections Manager
 5. Architect.
 6. Contractor's superintendent.
 7. Subcontractors.
- E. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Maintenance of progress schedule.
 7. Corrective measures to regain projected schedules.
 8. Planned progress during succeeding work period.
 9. Maintenance of quality and work standards.
 10. Effect of proposed changes on progress schedule and coordination.
 11. Other business relating to work.
- F. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

3.06 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:

1. Date.
2. High and low temperatures, and general weather conditions.
3. Safety, environmental, or industrial relations incidents.
4. Meetings and significant decisions.
5. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
6. Testing and/or inspections performed.
7. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
- E. Views:
 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.
 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.08 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.

5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

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

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 017800 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
- B. Shop Drawing Procedures:
 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
 2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- C. Transmit each submittal with a copy of approved submittal form.
- D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- G. Schedule submittals to expedite the Project, and coordinate submission of related items.
- H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- J. Provide space for Contractor and Architect review stamps.
- K. When revised for resubmission, identify all changes made since previous submission.
- L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

END OF SECTION

**SECTION 014000
QUALITY REQUIREMENTS**

TPART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. Mock-ups.
- D. Control of installation.
- E. Testing and inspection agencies and services.
- F. Contractor's construction-related professional design services.
- G. Control of installation.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 012100 - Allowances: Allowance for payment of testing services.
- B. Section 013000 - Administrative Requirements: Submittal procedures.
- C. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2025.
- C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2026.

1.04 DEFINITIONS

- A. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional in the State and locality of the project. .

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Where required by individual specification Sections.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and owner, and Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 MOCK-UPS

- A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

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

2.03 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

2.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment, and _____ as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

2.05 DEFECT ASSESSMENT

- A. Replace work or portions of the work not conforming to specified requirements.

END OF SECTION

**SECTION 014100
REGULATORY REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

- A. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. FFPC - Florida Fire Prevention Code, 8th Edition
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. FBC - Mechanical, Plumbing, Fuel Gas 2023
- F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. Escambia County Health Department.

1.02 RELATED REQUIREMENTS

- A. Section 014000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 014217
DEFINITIONS AND STANDARDS**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the General Conditions.
- B. Indicated refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.
- C. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
- D. A.D.A.- American Disabilities Act of 2010 and all revisions to date.
- E. Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
- F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
- G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
- H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."
- I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- J. The term "experienced," when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.
- K. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
- L. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- M. Verify or Verified: To make sure or demonstrate something is true, accurate, and justified.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's format and MASTERFORMAT numbering system.

- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
- C. Abbreviated Language: Language used in the Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and where the full context of the Contract Documents so indicates.
- D. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.
- B. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding
- C. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

END OF SECTION

**SECTION 015000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 015100 - Temporary Utilities.
- B. Section 015213 - Field Offices and Sheds.
- C. Section 015500 - Vehicular Access and Parking.

1.03 TEMPORARY UTILITIES - SEE SECTION 015100

- A. Contractor to provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
 - 4. Email: Account/address reserved for project use.
 - 5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular gates with locks. Provide additional fencing as may be deemed appropriate by Contractor for protection of the site and public.
- B. Fencing shall be screened with windscreen fabric equal to Fence Screen Privacy Plus 88% Blockage. Provide grommets and ties for securing screen to the fence. Zip ties are not acceptable. Logos or lettering is not acceptable. Color as selected by architect. Contractor shall coordinate extents of screen or move fencing as required in order to provide vehicular traffic with required sight distances at drives.

1.08 SECURITY

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

1.09 VEHICULAR ACCESS AND PARKING - SEE SECTION 015500

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES - SEE SECTION 015213

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

1.14 DRAINAGE

- A. Prevent mud, cement, concrete and other building materials from getting into major water bodies during the period of construction. Erect and maintain erosion control as per these documents and City and County requirements.

1.15 MAINTENANCE OF SANITARY SEWER LINES

- A. Clean any permanent piping in places that may become clogged. Under no condition, deposit in or about sanitary sewer lines such water used in flushing concrete or other cement mixes.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. General: Provide new materials; if acceptable to the Engineer/Landscape Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, no advertising and serviceable finishes. Provide a heated and air-conditioned unit on a foundation adequate for normal loading. It shall be located at a place agreeable to Owner and Contractor.
- C. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- D. First Aid Supplies: Comply with governing regulations.
- E. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide each facility ready for use when needed to avoid delay. Locate facility where it will not interfere with the construction of the project or the normal operations of any adjacent uses. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner and will not be accepted as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Contractor's option.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Contractor's Option.
- D. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities throughout the construction period. Pay all costs of installation, maintenance, and removal. Mobile/cell phones are acceptable.

3.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access and as approved by the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Keep on file in this office copies of all drawings, including all shop drawings, letters, specifications, and other records pertaining to this project.
- C. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
- D. Temporary enclosures: Provide temporary enclosures for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
- E. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NEPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80 degrees F (27 degrees C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Cover all hazardous openings at night and non-working hours. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing amber

END OF SECTION

**SECTION 015100
TEMPORARY UTILITIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 015000 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.08 TEMPORARY VENTILATION

- A. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.09 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 015213
FIELD OFFICES AND SHEDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary field offices for use of Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: use of premises and responsibility for providing field offices.
- B. Section 015000 - Temporary Facilities and Controls:
- C. Section 015000: Parking and access to field offices.
- D. Section 015500: Parking and access to field offices.

1.03 USE OF EXISTING FACILITIES

- A. Existing facilities shall not be used for field offices.

1.04 USE OF PERMANENT FACILITIES

- A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
- C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.
- D. Exterior Materials: Weather resistant, finished in one color.
- E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
- F. Lighting for Offices: 50 fc (538 lx) at desk top height, exterior lighting at entrance doors.
- G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Telephone: As specified in Section 015000.
- C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.
- D. Other Furnishings: Contractor's option.
- E. Equipment: Six adjustable band protective helmets for visitors, one 10 inch (250 mm) outdoor weather thermometer .

PART 3 EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

3.03 MAINTENANCE AND CLEANING

- A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.
- B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

- A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

**SECTION 015500
VEHICULAR ACCESS AND PARKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Construction parking controls.
- D. Flag persons.
- E. Haul routes.
- F. Maintenance.
- G. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: For access to site, work sequence, and occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Construction: Contractor's option.
- B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

- A. Use of existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.
- D. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

- A. Arrange for temporary parking areas to accommodate use of construction personnel.

3.04 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Prevent parking on or adjacent to access roads or in non-designated areas.

3.05 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.06 HAUL ROUTES

- A. Confine construction traffic to designated haul routes.
- B. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.07 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.08 MUD FROM SITE VEHICLES

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

END OF SECTION

**SECTION 015713
TEMPORARY EROSION AND SEDIMENT CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.
- B. Section 311000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- C. Section 312200 - Grading: Temporary and permanent grade changes for erosion control.
- D. Section 329223 - Sodding: Permanent turf for erosion control.
- E. Section 329300 - Plants: Permanent plantings for erosion control.
- F. Section 033000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.; 1999a (Reapproved 2014).
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015 (Reapproved 2023).
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a (Reapproved 2023).
- E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2021a.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.
- I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2015.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of State of Florida Department of Environmental Protection Erosion and Sedimentation Control Manual.
- C. Best Management Practices Standard: FHWA FLP-94-005.
- D. Runoff Calculation Standard for Urban Areas: USDA TR-55.

- E. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- F. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.
 - 2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 2 years.
- I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- M. Open Water: Prevent standing water that could become stagnant.
- N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Erosion and Sedimentation Control Plan:

1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 3. Obtain the approval of the Plan by authorities having jurisdiction.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- E. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
1. Straw or hay.
 2. Wood waste, chips, or bark.
 3. Erosion control matting or netting.
 4. Cutback asphalt.
 5. Polyethylene film, where specifically indicated only.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
1. Do not use Bahia grasses.
- C. Bales: Air dry, rectangular straw bales.
1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.

4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533/D4533M.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
8. Manufacturers:
 - a. TenCate: www.tencate.com/#sle.
 - b. North American Green: www.nagreen.com/#sle.
 - c. Propex Geosynthetics: www.geotextile.com/#sle.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 2. Softwood, 4 by 4 inches (100 by 100 mm) in cross section.
 3. Hardwood, 2 by 2 inches (50 by 50 mm) in cross section.
- G. Gravel: See Section 321123 for aggregate.
- H. Concrete: See Section 033000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 1. Width: As required; 20 feet (7 m), minimum.
 2. Length: 50 feet (16 m), minimum.
 3. Provide at each construction entrance from public right-of-way.
 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
 - c. Along the toe of cut slopes and fill slopes.
 - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart (at maximum of 60 m apart).
 - e. Across the entrances to culverts that receive runoff from disturbed areas.
 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet (30 m)..
 - b. Slope Between 2 and 5 Percent: 75 feet (23 m).
 - c. Slope Between 5 and 10 Percent: 50 feet (15 m).
 - d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
 - e. Slope Over 20 Percent: 15 feet (4.5 m).

- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Soil Stockpiles: Protect using one of the following measures:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges.
 - 2. Cover with mulch at least 4 inches (100 mm) thickness of straw or hay.
- H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
 - 2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.
- I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches (150 mm).
 - 2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
 - 3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.
- B. Silt Fences:
 - 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 - 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches (50 mm) of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
 - 7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
 - 8. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gage, 0.083 inch (2.11 mm) shank diameter.
 - 9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 - 10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).
- C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
 2. Install bales so that bindings are not in contact with the ground.
 3. Embed bales at least 4 inches (100 mm) in the ground.
 4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
 5. Fill gaps between ends of bales with loose straw wedged tightly.
 6. Place soil excavated for trench against bales on the upslope side of the row, compacted.
- D. Mulching Over Large Areas:
1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
 2. Asphalt: Apply at 1200 gallons per acre (11,000 L per hectare).
 3. Erosion Control Matting: Comply with manufacturer's instructions.
- E. Mulching Over Small and Medium Areas:
1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
 2. Asphalt: Apply 1/4 gallon per square yard (1 L per 100 sq m).
 3. Erosion Control Matting: Comply with manufacturer's instructions.
- F. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
 5. Incorporate fertilizer into soil before seeding.
 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep (12 to 25 mm).
 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE AND REPLACEMENT

- A. Inspect preventive measures monthly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair and replace fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

**SECTION 015719
TEMPORARY ENVIRONMENTAL CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Cleaning of ductwork is not contemplated under this Contract.
 - 2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.04 REFERENCE STANDARDS

- A. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 3 EXECUTION

2.01 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. Do not store construction materials or waste in mechanical or electrical rooms.
- D. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 - 1. Inspect duct intakes, return air grilles, and terminal units for dust.
 - 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 - 3. Clean tops of doors and frames.
 - 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 - 5. Clean return plenums of air handling units.
 - 6. Remove intake filters last, after cleaning is complete.

- E. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

**SECTION 015813
TEMPORARY PROJECT SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.
- B. Project informational signs.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Responsibility to provide signs.

1.03 QUALITY ASSURANCE

- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: (for Project Identification) Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, x 4 foot x 8 foot sign supported by PT wood frame and two 6 x 6 PT post set in Concrete.
- C. Rough Hardware: Galvanized.
- D. Paint and Primers: Exterior quality, two coats; sign background of _____ color.

2.02 PROJECT IDENTIFICATION - SIGN SEE SIGN MATERIALS

- A. Content:
 - 1. Project title, logo and name of Owner as directed by architect.
 - 2. Names and titles of authorities.
 - 3. Names and titles of Architect.
 - 4. Name of Prime Contractor.
- B. Graphic Design, Colors, Style of Lettering: Designated by Architect.

2.03 PROJECT INFORMATIONAL SIGNS

- A. Provide at each field office, storage shed , and directional signs to direct traffic into and within site. Relocate as Work progress requires.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 20 days after date fixed by Notice to Proceed.
- B. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- C. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

- A. Maintain signs and supports clean, repair deterioration and damage.

END OF SECTION

**SECTION 016000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Lists of products to be removed from existing building.
- B. Section 014000 - Quality Requirements: Product quality monitoring.
- C. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 016116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 016116.
 - 3. Have a published GreenScreen Chemical Hazard Analysis.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.
- B. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required.
- C. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- E. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- F. Substitution Submittal Procedure (after contract award):
 - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures.
- B. Section 014000 - Quality Requirements: Procedures for testing and certifications.
- C. Section 016000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 079200 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Thermal and acoustical insulation.
 - 7. Free-standing furniture.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

- D. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

- A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

**SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 014000 - Quality Requirements: Testing and inspection procedures.
- C. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 015100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- E. Section 015713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
- F. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- G. Section 024100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- H. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
- B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.06 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 2. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- M. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- N. Existing utilities and equipment: 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 and other construction. Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction with construction.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- D. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - 1. Foundation construction.
 - 2. Bearing and retaining walls.

3. Structural concrete.
 4. Structural steel.
 5. Lintels.
 6. Timber and primary wood framing.
 7. Structural decking.
 8. Stair systems.
 9. Miscellaneous structural metals.
 10. Exterior curtain wall construction.
 11. Equipment supports.
 12. Piping, ductwork, vessels and equipment.
 13. Structural systems of special construction in Division-13.
- E. Contractor to provide insect control and vapor tight at structure (example: exterior cuts - patching of vapor retarder). All openings or penetrations made to be well-sealed from insect or rodents with plaster, "play" sand, copper gauze - contractor to adhere to all applicable fire ratings.
- F. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- G. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
1. Primary operational systems and equipment.
 2. Membranes and flashings.
 3. Fire protection systems.
 4. Communication systems.
 5. Electrical wiring systems.
- H. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- I. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- J. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- K. Restore work with new products in accordance with requirements of Contract Documents.
- L. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- M. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
- N. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- O. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

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

- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- B. Refer to requirements of General Conditions of the Contract for Construction.
- C. Substantial Completion
 - 1. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
 - 2. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
 - 3. Notify Architect of intended date of Substantial Completion as early as is feasibly possible. Architect will schedule Final Inspection of the work with Owner, Architect's Consultants, and the Escambia County building code Administrator / Building Official. Contractor shall coordinate attendance of the Final Inspection by local Fire Department and other code officials requiring attendance.
 - 4. Upon completion of the Final Inspection, if the work is deemed substantially complete, the Architect will distribute a Certificate of Substantial Completion with "Punch List" of items required to be corrected by the Contractor prior to Final Acceptance of the Work.
- D. Final Acceptance
 - 1. Correct items of work listed in executed Certificates of Substantial Completion.
 - 2. Notify Architect when work is considered finally complete.
 - 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
 - 4. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 - 5. If necessary, reinspection will be repeated until all items of work are completed.
 - 6. Submit final meter readings for utilities and similar data as of the date of Substantial Completion.
 - 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

- 8. Submit the final payment request with releases and supporting documentation as outlined in the General Conditions of the Contract for Construction.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. **Obtain Certificate of Occupancy and written Final approval from governing authorities and Code officials. Present a copy to owner and architect.**

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

**SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- E. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- D. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- E. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Owner.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 - 6. Material Reused on Project: Include the following information for each:

- a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Pre-bid meeting.
 2. Pre-construction meeting.
 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 1. Provide containers as required.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

**SECTION 017800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
 - 1. Architect will review record documents with Contractor's project manager after each progress meeting, or at intervals appropriate to the project, to ensure record documents are being kept accurate and up to date with the progress of the project.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Contractor to provide one paper copy and one digital copy in Autocad 2000 format on compact disc. All noted changes to be clouded.
- G. **Obtain Certificate of Occupancy and written Final approval from governing authorities and Code officials. Present a copy to owner and architect.**

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- J. Include test and balancing reports.
- K. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.

- E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 4 inch (____ mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
- N. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- I. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- J. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- K. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

END OF SECTION

**SECTION 024100
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective building demolition
- B. Selective demolition of site elements.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 015713 - Temporary Erosion and Sediment Control.
- D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- G. Section 311000 - Site Clearing: Vegetation and existing debris removal.

1.03 DEFINITIONS

- A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.

1.06 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 EXECUTION

2.01 DEMOLITION

- A. **Refer to the drawings** for Demolition requirements.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Demolition and Stripping:

- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Provide, erect, and maintain temporary barriers and security devices.
 - 3. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 4. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 5. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 6. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Protect existing structures and other elements to remain in place and not removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.

2.03 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 033000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 3680 - Dyed and Polished Concrete.
- B. Section 09 6460 - Wood Athletic and Sports Flooring.
- C. Section 07 2616 - Integrally Bonded Underslab Vapor Retarder.
- D. Section 079005 - Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.
- E. Section 09 3000 - Tiling
 - 1. **Provide depressed slab in all Shower compartments to achieve sloped tile floor to shower drain utilizing thick setting bed for slope.**
- F. Section 09 9123 - Interior Painting: Sealed Concrete Floor Coating.
- G. Section 09 0561 - Common Work Results for Flooring Preparation
- H. Section 12 4813 - Entrance Floor Mats and Frames
 - 1. **Provide depressed slab in Room 101 & 121 - Entrance Vestibules per Manufacturer's requirements.**

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI 301 - Specifications for Concrete Construction; 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting; 2020.
- G. ACI 306R - Guide to Cold Weather Concreting; 2016.
- H. ACI 308R - Guide to External Curing of Concrete; 2016.
- I. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- J. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- K. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- L. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
- N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

- O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2026.
- P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.
- Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- R. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.
- U. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- V. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2026.
- W. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- X. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- Y. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2024.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- AA. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
- BB. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2022).
- CC. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop; 1974.
- DD. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- D. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
- E. Samples: Submit samples of underslab vapor retarder to be used.
- F. Test Reports: Submit report for each test or series of tests specified.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- I. 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:
- J. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Retain list below with either paragraph above. Edit to suit Project.
 - 2. Cementitious materials and aggregates.

3. Form materials and form-release agents.
 4. Steel reinforcement and reinforcement accessories.
 5. Admixtures.
 6. Waterstops.
 7. Curing materials.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor retarders.
 12. Epoxy joint filler.
 13. Joint-filler strips.
 14. Repair materials.
- K. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- L. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mix water to be withheld for later addition at Project site.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- F. **Testing Agency** Qualifications: An independent testing agency **as provided by owner**, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. **Retesting if failed test to be provided and paid for by the General Contractor.**
1. Retain subparagraph below, required by ACI 301 and ASTM C 31/C 31M, if emphasis is needed. ASTM C 1077 notes relevant field or laboratory technician certification by ACI, NRMCA, PCA, or National Institute for Certification in Engineering Technologies may demonstrate evidence of competence.
 2. 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.
- G. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- H. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance including:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) First imparts glossy finish, second imparts matte finish, and third and fourth impart coarser-textured finish depending on face-ply characteristics.
 - 2) High-density overlay, Class 1, or better.
 - 3) Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
 - 4) Structural 1, B-B, or better, mill oiled and edge sealed.
 - 5) B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
 - 2. 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.
 - 3. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, Plain Type.
 - 1. Form: Coiled Rolls.
 - 2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Provide solid concrete bricks to support bottom mats of spread footings and bottom bars in grade beams where rebar support will be in direct contact with soil. Concrete brick sizes as required to provide specified concrete cover.
 - b. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
 - 3. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I, I/II, II or V - Normal Portland Type
- B. Fine and Coarse Aggregates: ASTM C 33.
 - 1. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).
- C. Fly Ash: ASTM C618, Class F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement. Do not use admixtures containing calcium chloride.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

- A. **Integrally Bonded Underslab Vapor Retarder: Refer to Specification Section 07 2616 - Integrally Bonded Vapor Protection and Drawings.**

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 - 1. Two-component epoxy resin, capable of humid curing and bonding to damp surfaces.
 - 2. Class and grade to suit requirements, and as follows:
 - a. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Waterstops: Rubber, complying with COE CRD-C 513.
 - 1. Factory fabricate corners, intersections, and directional changes.
 - 2. Profile: Flat, dumbbell with center bulb.
 - 3. Acceptable Manufacturers:
 - a. Greenstreak..
 - b. Progress Unlimited Inc..
 - c. Westec Barrier Technologies; Div. of Western Textile Products, Inc..
 - d. Williams Products, Inc.
- D. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
 - 1. Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet.
- E. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
- F. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard, felt, or cork, complying with ASTM D 1751, 1/4 inch thick (6 mm thick) and 4 inches deep (200 mm deep); tongue and groove profile.

- G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- H. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- I. Sealant and Primer: As specified in Section 079005.

2.07 CURING MATERIALS

- A. Moisture-Retaining Sheet: ASTM C171.
 - 1. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch (0.10 mm).
 - 2. White-burlap-polyethylene sheet, weighing not less than 10 ounces per linear yard, 40 inches wide (305 g/sq m).
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- E. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Evaporation Retarder:
 - a. Spray-Film; ChemMasters.
 - b. Eucobar; Euclid Chemical Co.
 - c. E-Con; L&M Construction Chemicals, Inc.
 - d. Rich Film; Richmond Screw Anchor Co.
 - e. Finishing Aid; Symons Corporation.
 - 2. Clear, Waterborne, Membrane-Forming Curing Compound:
 - a. AH Clear Cure WB; Anti-Hydro International, Inc.
 - b. High Seal; Conspec Marketing & Manufacturing Co., Inc.
 - c. Cure & Seal 309 Emulsion; Kaufman Products Inc.
 - d. Vocomp-20; W. R. Meadows, Inc.
- F. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Refer to Structural drawings for additional concrete design mixes, where conflicts existing, use the most stringent requirements.
- B. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 - 1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.
- C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ qualified, independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- D. Footings and Piers where indicated on the drawings. : Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa), unless noted otherwise.
 - 2. Maximum Slump: 5 inches (100 mm).
 - 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 3-inch (50- to 100-mm) slump.
- E. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi (20.7 MPa), unless otherwise noted.
 - 2. Maximum Slump: 5 inches (100 mm).

- F. Outside Porches and Associated Concrete: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi (34.5 MPa), unless otherwise noted.
 - 2. Maximum Slump: 4 inches (100 mm).
- G. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- H. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 20 percent.
- I. Maximum Water-Cementitious Materials Ratio: 0.57 for concrete with a 28 day compressive strength of $F'c = 3000$ psi, unless otherwise noted.
- J. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete with a 28 day compressive strength of $F'c = 4000$ psi, unless otherwise noted.
- K. Limit water - soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- L. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 4 to 6 percent, unless otherwise indicated.
- M. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizers) 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.

2.09 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

- B. Verify that forms are clean and free of rust before applying release agent.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches (150 mm) or greater if required by manufacturer. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering. **Refer to Section 07 2616.**
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
- F. Ensure vapor barrier is installed in accordance with project specifications prior to placing concrete. Refer to Division 07.

3.03 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Classes are taken from ACI 347R. See Evaluations.
 - 2. Class A, 1/8 inch (3 mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- 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.
- 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.

3.04 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 75 percent of 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched or damaged forms for concrete surfaces unless approved by Architect

3.05 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

3.06 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.
 - 2. Install reglets to receive top edge of foundation sheet 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 and required.

3.07 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete. Refer to Division 07.
- B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- C. Install welded wire reinforcement in maximum possible lengths on bar supports spaced to minimize sagging and offset end laps in both directions. 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.
- D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
 - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.08 VAPOR RETARDERS

- A. Vapor Retarder: Refer to Division 7.
- B. Granular Fill: Cover compacted subgrade with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.09 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.

- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.10 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.
- E. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- F. 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 slabs on grade.
 - 2. Form from preformed, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise 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.
 - 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- G. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- H. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- I. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.11 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.12 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

3.13 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (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 mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture

- temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (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. 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.

3.14 CONCRETE FINISHING

- A. Finishing Formed Surfaces
1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
 - a. Apply to concrete surfaces of retaining walls to be covered with earth backfill.
 2. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
 - a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - b. Do not apply rubbed finish to smooth-formed finish.
 3. Rubbed Finish: Apply the following to smooth-formed finished concrete:
 - a. 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.
 4. 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.
 5. All exposed finished concrete of areaway walls which would include surfaces above grade and inside the areaway shall be formed with MDO plywood.
 - a. All tie holes shall be pointed and patched with matching material. Grind all joints smooth. Smooth rub finish as noted above.
- B. Finishing Floors and Slabs
1. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 2. 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.
 - a. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

3. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen 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.
 - a. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 - b. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - 1) Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
 - 2) For slab on grade areas receiving thin set tile, the overall minimum values of flatness shall be, F(F) 50 and the levelness, F(L) 35. Local values of flatness shall be, F(F) 35, and levelness, F(L) 20.
4. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

3.15 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.16 CURING AND PROTECTION

- A. Surfaces Not in Contact with Forms:
 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
- B. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (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.
- D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, 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.
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.

3.17 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.18 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 months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: **Owner will engage a qualified independent testing and inspecting agency** to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements: All retesting as a result of failed test to be provided by and paid for by the General Contractor.
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix 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. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimens at 7 days and two at 28 days. Hold fourth specimen for future specimen for future testing if required. Discard if not required.

- a. The contractor shall engage a qualified independent testing laboratory to make, field cure, and test standard cylinder specimens. The results of these tests shall be used by the contractor to evaluate field curing and for form removal.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. 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.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. 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.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

3.20 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-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 in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (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. 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 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 mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. 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.

END OF SECTION

**SECTION 033680
CONCRETE POLISHING AND DYING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes polished concrete finish for interior concrete floors denoted on Finish Schedule as DPC (Dyed Polished Concrete). Polished concrete finished for pre-cast concrete, vertical cast-in-place concrete, and exterior concrete are specified in the sections for those types of concrete.
- B. Furnish all labor, material, equipment and services necessary for the dry diamond grinding and polishing of concrete floors.
- C. Applying densifying impregnator/sealer and polishing to specified sheen level and aggregate exposure.
- D. Concrete must be cured a minimum of 28 days prior to polishing.
- E. Areas to receive dyed polished concrete (DPC) include but not limited to existing concrete floors with existing finishes. All existing finishes to receive DPC shall be removed and prepared by the DPC manufacturers and installation contractors requirements. Installation of DPC indicates acceptance of the concrete substrate.

1.03 REFERENCES

- A. American Concrete Institute (ACI):
- B. American Society for Testing and Materials:
 - 1. ASTM C779, Standard Test Method for Abrasion of Horizontal Concrete Surfaces
 - 2. ASTM C805, Impact Strength
 - 3. ASTM G23-81, Ultraviolet Light and Water Spray
 - 4. ASTM 1028, Co-Efficient of Friction
 - 5. ASTM C 150, Type I, II Portland cement conformity, depending on soil conditions
 - 6. ASTM C 33, Aggregate conformity
- C. Other Tests:
 - 1. Reflectivity

1.04 SUBMITTALS

- A. Submit the following in accordance with Submittal Procedures in Division 1 Sections.
- B. Product data for concrete densifying impregnator, penetrating sealer, concrete dyes, joint filler and any other chemicals used in the process.
- C. Applicators qualification data.
- D. Polished concrete samples: size 3"x3" for each Polished Concrete finish required.
- E. Maintenance procedures for Polished Concrete using diamond impregnated cleaning pads.

1.05 QUALITY ASSURANCE

- A. Basis of design: Polished Concrete
- B. Certified Contractors:
 - 1. Pre-qualified contractors meeting ALL requirements set forth within specifications.
 - 2. Substitutions will be allowed or approved only per contract document requirements and Section 01 6000 Product Requirements.
- C. Pre-Pour Installation Conference: Conduct conference at project site to comply with requirements in Division 1 Sections "Special Conditions" and "Administrative Requirements".

- D. Provide project names, addresses, contact names, phone numbers, of at least three (3) projects of similar scope and size completed by the installer.
- E. Manufacturer's Certification: Provide letter of certification stating that the installer is a certified applicator and is familiar with proper procedures and installation requirements recommended by the manufacturer.
- F. Mock-ups:
 - 1. Mock-ups to be approximately 100 square feet per color and finish in location indicated or if not indicated, as directed by the Architect or Owner Representative.
 - 2. Install mock-ups to verify selections made under sample submittal and to demonstrate methods and workmanship proposed for the project.
 - 3. Control joints should be included in mock-up. Sawing performed by General Contractor can begin as soon as the surface is firm enough not to displace any of the aggregate.
 - 4. Edges should be included in mock-up.
- G. Protection: General Contractor shall protect areas to receive polished concrete finish at all times during construction to prevent oils, dirt, metal, excessive water and other potentially damaging materials from affecting the finished concrete surface. Protection measures listed below shall begin immediately after the concrete slab is poured:
 - 1. All hydraulic powered equipment shall be diapered to avoid staining of the concrete.
 - 2. All vehicle parking shall be prohibited on the finish slab area. If necessary to complete their scope of work, drop clothes shall be placed under vehicles at all times.
 - 3. No pipe cutting machine shall be used on the finish floor slab.
 - 4. Steel shall not be placed on the finish slab to avoid rusting.
 - 5. Acids and acidic detergents will not come in contact with slab.
 - 6. All painters will use drop cloths on the concrete. If paint gets on the concrete, it must be removed immediately.
 - 7. All trades will be informed that the slab must be protected at all times.
- H. Environmental Limitations
 - 1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.
 - 2. Flatness and Levelness (for new concrete)
 - a. Finished concrete shall have a minimum Floor Flatness rating of at least 40
 - b. Finished concrete shall have a minimum floor levelness rating of at least 30
 - c. Finished concrete shall be cured a minimum of 28 days or at which point equipment can be put on the slab and does not displace aggregate.
 - 3. Application of finish system shall take place a minimum of 21 days prior to fixture and trim installation and/or substantial completion.
 - 4. Finished concrete area shall be closed to traffic during finish floor application and after application, for the time as recommended by manufacturer.
- I. Concrete Mix Design
 - 1. Concrete Mixture shall be 3000 PSI or higher, non-air entrained.
 - a. Any admixtures, plasticizers, slag, fly ash or anything taking the place of Portland based cement shall be kept to a minimum.
 - b. The cement shall be Portland Cement Type I, conforming to ASTM C150.
 - c. Maintain concrete temperature below 85 degrees. Keep concrete cool and moist for as long as possible. In essence, decrease rate of hydration and drying to minimize cracking.
 - d. A dissipating cure and seal may be used, if required.
 - e. All mix designs must be approved by the Architect. Send all approved mix designs to Installer/Applicator.
 - f. The Engineer/Architect shall determine the sawcut pattern, color and layout.
 - g. Color loads for integral color should never be smaller than three (3) cubic yards.

- h. Use one (1) source for cement, aggregates, and pozzolans throughout the job. Monitor and control incoming material consistency. Do not use calcium chloride-based admixtures. Non-chloride admixtures may be used.
- i. Wash out all drums before loading. Keep slumps consistent with a maximum of four (4). Minimize driver added water maintaining a .45 water content ratio.
- j. Place concrete to achieve as true and smooth of a top surface as possible. Mounds or dips are not acceptable. General Contractor shall control overall flatness and levelness, including on sloping areas to within tolerances permitted by specification ASTM E1155.
- k. Slab shall be protected from indentation and footprints during pour and curing.

PART 2 – PRODUCTS

2.01 POLISHING MATERIALS

- A. Three-phase 480 Volt generator
- B. Three (3) head or four (4) head counter rotating, variable speed, electric floor grinding/polishing machines with at least 600 pounds down pressure. For example: HTC 950RX, HTC 800HD, SASE PDG 8000, Husqvarna PG820. No substitutes allowed.
- C. HTC/Pullman Dust extraction system, pre-separator, and squeegee attachments with minimum flow rating of 322 cubic feet per minute such as the HTC 75D, HTC 86D, T8600, T12600, Bull 500, Bull 1250 & T55 or C5500. No substitutes allowed.
- D. Grinding Tools
 - 1. Metal bonded diamonds 16, 25, 40, 80, and 150 grits
 - 2. Resin bonded diamonds 100, 200, 400, 800 and 1500 grits
- E. Grinding Pads for Edges
 - 1. 30, 60 and 120 grits
 - 2. 100, 200, 400 and 800 grits
- F. Hand Grinder with dust extraction attachment and pads.
- G. Densifier: A concrete hardener chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless which hardens and densifies concrete surfaces to protect against abrasion, dusting, and absorption of liquids.
 - 1. Consolideck LS; Lithium Silicate; PROSOCO
 - 2. Ultrasil Li; Lithium Silicate; The Euclid Chemical Company
 - 3. Scofield Formula One Lithium Densifier; L.M. Scofield Company
 - 4. LionHard; Lithium Silicate; L & M Construction Chemicals
 - 5. No substitutions allowed.
- H. Control Joint and Sawcut Filler, two part polyurea.
 - 1. Spal-Pro RS 88 Semi-Rigid Polyurea Joint Filler; Metzger-McGuire
 - 2. Hi-Tech Polyurea PE-85; Hi-Tech Systems
 - 3. Euco QwikJoint 200, The Euclid Chemical Company
 - 4. No substitutions allowed.
- I. Dye: A penetrating dye that chemically combines with cured concrete to produce permanent, variegated or translucent color effects. **Provide full manufacturer's color line for architect's selection.** Available in water-based or solvent-based formulas (VOC compliant).
 - 1. Consolideck GemTone Stain; PROSOCO
 - 2. Ameripolish Dye; American Decorative Concrete
 - 3. Scofield Formula One Liquid Dye Concentrate; L.M. Scofield Company
 - 4. No substitutions allowed.
- J. Stain Guard: Protect from debris and contaminants.
 - 1. Consolideck LSGuard; PROSOCO
 - 2. UltraGuard; The Euclid Chemical Company
 - 3. Scofield Formula One Guard-W; L.M. Scofield Company

4. Petrotex; L & M Construction Chemicals
 5. No substitutions allowed.
- K. Diamond Impregnated Cleaning Pads
1. Consolideck Heat Pad; PROSOCO, Inc.
 2. Magic Polishing Pad; SASE Company
 3. Twister Polishing Pad;

PART 3 – EXECUTION

3.01 PREPARATION

- A. Installer shall examine and approve concrete substrate for conditions affecting performance of finish. General Contractor shall correct conditions that are found to be out of compliance with the requirements of this section. Repairs are not acceptable unless specifically approved on a case-by-case basis by the Architect.
- B. Verify that base slab meets finish and surface profile requirements listed in Division 3, Section "Cast in Place Concrete".
- C. Provide floor clean of materials and debris.
- D. Protect adjacent surfaces as required to prevent damage by the concrete polishing procedure.
- E. Set up grinding machine, dust extraction system, tooling and generator.
- F. Ensure floor cured to accept polishing application.

3.02 POLISHED CONCRETE APPLICATION

- A. Applicator shall examine the areas and conditions under which work of this section will be provided and the General Contractor shall correct conditions detrimental to the timely and proper completion of the work and the Applicator shall not proceed until unsatisfactory conditions are resolved.
- B. Fill construction joints and cracks with filler products as specified in accordance with manufacturers instructions colored to match (or contrast) with concrete color as specified by architect. All control joint and decorative sawcut filling must be performed prior to grinding application.
- C. Grind the concrete floor to within 2-3 inches of walls with 16, 25, 40 and 80 grit removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure is achieved. Vacuum the floor thoroughly using a squeegee vacuum attachment. Utilize the least aggressive diamond tooling necessary to remove all debris and to achieve uniform scratch pattern.
- D. Grind the edges with 30, 60, and 120 grit grinding pads, prior to grinding the floor with each step on the larger diamond grinder, removing all of the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- E. Grind the floor to within 2-3 inches of walls with metal bonded diamond grits of 150 and/or 300, grinding 90 degrees from each previous grind and removing all the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- F. Polish the floor with resin bonded diamond grits of 100, 200, 400, first polishing the edges (if specified) with pads of the same grit and then the field of the floor, removing all scratches from the previous grit. After each polish, clean the floor thoroughly using a vacuum with a squeegee attachment. After the 400 grit polishing step thoroughly clean the floor with a mop or auto-scrubber to prepare for dye.
- G. Apply dye color per manufacturer's recommendations. Apply two (2) coats of dye to achieve desired coloration.
- H. Apply densifying impregnator undiluted as per manufacturer's specifications and guidelines. Cover the entire work area liberally and allow to sit for ten (10) minutes. Apply again to areas where the densifying impregnator has soaked in and allow to sit for an additional thirty (30) minutes. Squeegee excess material off the floor.

- I. Polish the floor with resin bonded diamond grit of 800, first polishing the edges (if specified) with pads of the same grit and then the field of the floor, removing all scratches from the previous grit. After polishing, clean the floor thoroughly using clean water and an auto scrubber or a mop and a wet vacuum.
- J. Apply stain guard with a micro-fiber applicator and burnish with a fine 800 grit, or very fine 1500 grit diamond impregnated cleaning pad.
- K. Upon completion, the work shall be ready for final inspection and acceptance by the customer.

PART 4 – SCHEDULES

4.01 SHEEN

- A. Polished Concrete Level 3 - Polished, Image Clarity Value 40-69%

END OF SECTION

**SECTION 042000
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clay facing brick.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 04 7200 - Cast Stone Masonry
- C. Section 055000 - Metal Fabrications: Loose steel lintels.
- D. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
- E. Section 071113 - Bituminous Dampproofing: Dampproofing parged masonry surfaces.
- F. Section 072100 - Thermal Insulation: Insulation for cavity spaces.
- G. Section 07 2726 - Fluid Applied Membrane Air Barrier
- H. Section 076200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- I. Section 07 6526 - Self Adhering Sheet Flashing.
- J. Section 07 9005 - Joint Sealers

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
- D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2025.
- G. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
- H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
- I. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2026.
- J. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026a.
- K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2026.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

- M. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2026a.
- N. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.
- O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2026.
- P. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- Q. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- R. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.
- S. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- T. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- U. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).
- V. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).
- W. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit four samples of split face masonry veneer units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience. **Submit to architect and owner for approval before beginning any work.**

1.06 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
- B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 BRICK UNITS

- A. Manufacturers :
 - 1. Basis of Design: Taylor Clay Products, Inc.
 - a. Contact: Dudley Gordon, Capitol Brick Co. (334) 850-2489
- B. Facing Brick: ASTM C216, Type ____, Grade ____.
 - 1. Compressive strength: _____, measured in accordance with ASTM C67/C67M.

2. Color : Match existing brick on site.
3. Size: Modular
4. Texture: Match existing brick on site.
5. Substitutions: See Section 01 6000-Product Requirements.

2.02 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units shall conform to ASTM C90. Refer to Structural Drawings for unit and grout strength requirements.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type S.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 1. Color(s): As selected by Architect from manufacturer's full range.
- F. Water: Clean and potable.
- G. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
 1. Use only in combination with masonry units manufactured with integral water repellent admixture.
 2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
 3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 1. Blok-Lok Limited; _____: www.blok-lok.com/#sle.
 2. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com/#sle.
 3. WIRE-BOND; _____ www.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; _____.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1875 inch (4.8 mm) side rods with 0.1875 inch (4.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure. Provide special T and L shapes at wall intersections. Space ties 16" vertically.
- E. Adjustable Multiple Wythe Joint Reinforcement: Truss or ladder type with adjustable ties spaced at 16 in (406 mm) on center ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch (4.8 mm) side rods with 0.1875 inch (4.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm) wire; width of components as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from each masonry face.
- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.

- G. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch (4.8 mm) thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in (32 mm). Fasten through sheathing into structural backup.. Space ties 16" vertically and horizontally. Recover and coat screws and fasteners with Fluid Applied Membrane Air Barriers per Section 07 2726.
- H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B. Space ties 16" vertically and horizontally.
 - 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.05 FLASHINGS

- A. Flashing Materials: Self-adhering Sheet Wall Flashing, termination bar, and drip edge as specified in Section 07 6526 Self-adhering Sheet Flashing.
- B. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints. Refer to structural drawings for additional requirements for masonry control joints. Contractor shall be responsible for locating and placing joints as specified.
 - 1. Manufacturers:
 - a. Blok-Lok Limited; .: www.blok-lok.com.
 - b. Hohmann & Barnard, Inc; .: www.h-b.com/sle.
 - c. WIRE-BOND; .: www.wirebond.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl Chloride; oversized 50 percent to joint width; self expanding.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc; .: www.h-b.com/sle.
 - b. WIRE-BOND; .: www.wirebond.com/#sle.
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
- D. Weeps:
 - 1. Type: Extruded propylene with honeycomb design. 3/8" thick x depth and height as required.
 - 2. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Manufacturers:
 - a. Advanced Building Products, Inc; .: www.advancedbuildingproducts.com/#sle.
 - b. Blok-Lok Limited; .: www.blok-lok.com/#sle.
 - c. CavClear/Archovations, Inc: www.cavclear.com/#sle.
 - 1) Hohmann & Barnard, Inc; Quadro-Vent: www.h-b.com/#sle.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 LINTELS

- A. Install galvanized lintels, primed and painted.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.
- C. **Refer to Structural.**

2.08 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. **Masonry below grade and in contact with earth: Type S.**
 - 2. **Exterior, loadbearing masonry: Type MN**
 - 3. **Exterior, non-loadbearing masonry: Type MN**
 - 4. Interior, loadbearing masonry: Type S.
 - 5. Interior, non-loadbearing masonry: Type S.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
 - 1. Refer to structural drawings for specified compressive strengths.
- D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- E. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.
- D. Brick Units:
 - 1. Bond: Running - **Horizontal running bond as shown on drawings.**
 - 2. Coursing: At running bond three units and three mortar joints to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.

- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, un-chipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 32 inches (800 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. **Refer to drawings for details.**

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHER MASONRY, AND CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Lap joint reinforcement ends as indicated on structural drawings. If not shown, lap a minimum of 6".
- C. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.
- D. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches (___ mm) horizontally and 16 inches (400 mm) vertically.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (___ mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.10 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Terminate flashing up 8 inches (203 mm) minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing over fluid-applied or self-adhere air/vapor barriers and terminate with stainless steel termination bar and sealant.
- C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- D. Extend self adhered sheet flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

3.11 GROUTED COMPONENTS

- A. **Refer to the Structural Drawings for reinforcing bar lap splice lengths.**
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.13 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.14 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

**SECTION 045600
TUCKPOINTING MASONRY WALLS**

PART 1 - GENERAL

1.01 SUMMARY:

- A. Work included in this section:
- B. Tuck Pointing of existing masonry brick walls as determined by architect and owner's representative during construction.
 - 1. Selective tuckpointing of deteriorated and defective mortar joints in masonry walls
- C. Definitions:
 - 1. Tuckpointing: The process of removing deteriorated and defective mortar from the joints of existing masonry wall and replacing with new mortar.
 - 2. Deteriorated and defective mortar: Any mortar joint exhibiting cracks, spalls, voids, powdering, efflorescence or any other noted deficiencies that may prevent high resistance to water penetration.

1.02 SUBMITTALS:

- A. Product data: Submit manufacturer's product specifications and mixing and installation instructions for each manufactured product.
- B. Samples:
 - 1. Submit actual mortar samples for colored mortar, or mortar chosen to match existing work and, indicating color range of each color selected.
 - a. Provide (1) 4' x 4' tuckpointing mockups at locations selected by Owner on the building, showing tuckpointing mortar and masonry craftsmanship for project acceptability prior to commencing work.
 - 1) Do not proceed further until mockup is approved.

1.03 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials, except aggregate, in original unopened containers displaying product name, type, grade and mixing instructions.

1.04 JOB CONDITIONS:

- A. Environmental requirements:
 - 1. Perform no tuckpointing when temperature of surrounding air has dropped below 45 degrees F., unless it is rising; and at no time when it has dropped below 40 degrees F.
 - 2. Maintain air temperature above 40 degrees F. on both sides of masonry for at least 72 hours after performing tuckpointing.
- B. Protection of work:
 - 1. During repairs, keep walls dry by covering at end of each day or shutdown period with a waterproof membrane, anchored and overhanging each side of wall at least 2'-0".
 - 2. Remove misplaced mortar or grout immediately.
 - 3. Protect face materials against staining.
 - 4. Protect sills, ledges and offsets from mortar droppings during construction.
- C. Sequencing and scheduling: Do not enclose or cover work requiring inspection until such work has been accepted.

1.05 QUALITY ASSURANCE:

- A. For each type of cement specified, only one brand shall be used throughout project.
- B. Applicable standards:
 - 1. Standard of the American Society for Testing and Materials (ASTM), as referenced herein.
 - 2. "Technical Notes on Brick Construction", by The Brick Institute.
- C. Tuckpointing shall be done only by qualified and experienced tuckpointing craftsmen. Individuals who are excellent masons/bricklayers may not be good tuckpointing craftsmen.

Contractor shall test and evaluate the skills of its personnel prior to the selection of the craftsmen for the project. Project mockups are required to verify skills. Only craftsmen who have demonstrated their skill via approved mockups shall perform tuckpointing on the project.

1. Mortal removal mock-up
 - a. The selected Contractor shall perform a 4 sq. ft. mock-up if the Contractor wants to use mechanical tools for mortar removal.

PART 2 - PRODUCTS

2.01 MORTAR AND ACCESSORY MATERIALS:

- A. Portland cement: Meeting ASTM C150-92, Type I, natural color, domestic manufacturer.
- B. Masonry cement: Meeting ASTM C91-91, Type N, non-staining, 22% maximum air content by volume and proportioned to comply with requirements of ASTM C270-89 for Type N mortar.
- C. Hydrated lime: Meeting ASTM C207-91 (1992), Type S.
- D. Mortar color: **Inert, pure mineral additives in colors selected to match existing mortar.**
- E. Aggregate for mortar: Clean, hard, natural, washed sand meeting ASTM C144-91.
- F. Water: Clean, potable, free from deleterious amounts of alkalies, acids and organic materials.
- G. Bonding agent: Thoro Systems, Acryl-60 to be mixed into tuckpointing mortar, as part of mixing water.
- H. Integral Water Repellent: W. R, Grace Dry Block, to be mixed into tuckpointing mortar

2.02 MORTAR PROPORTIONS:

- A. Type N job-mixed or bag-mixed mortar for pre-mixed, colored masonry cement: Proportion materials by volume in accord with ASTM C270 (current version), as follows: One part pre-mixed Type N masonry cement to aggregate proportioned not less than 2-1/4 nor more than three times the volume of masonry cement used, and as directed by masonry cement manufacturer's product data to produce Type N mortar.

2.03 JOB MIXING:

- A. Mix mortar in power-driven drum type mixers. Operate mixer minimum of five minutes after addition of all materials. Do not retemper mortar. Discard partially set material.
- B. Bonding agent: Liquid bonding agent for tuckpointing mortar is to be mixed within the water used to prepare the tuckpointing mortar. Mix the acrylic-based bonding agent additive 1:3 with clean potable water (1 part additive to 3 parts water) to prepare the mix water. Prepare the remaining mortar proportions as specified. Do not apply a brush-on coat of pure acrylic additive or additive mixed with water, to cut back mortar joints.
- C. Addition of other admixtures, including antifreeze ingredients, will not be permitted.
- D. Measure materials for job-mixed mortars in a one cubic foot container. Do not measure by shovels.
- E. Pre-hydrate tuckpointing mortar, to reduce excessive shrinkage, as follows:
 1. Mix all dry ingredients thoroughly.
 2. Add only enough clean water (no bonding agent) to produce a damp workable consistency which will retain its shape when formed into a ball.
 3. Allow mortar to stand in dampened condition for 1 to 1-1/2 hours.
 4. After pre-hydration time period, add water with bonding agent to bring to a workable consistency (somewhat drier than conventional mortar).
 5. Proceed with tuckpointing.

PART 3 - EXECUTION

3.01 TUCKPOINTING:

- A. Rout or cut out mortar joints to a uniform depth of 1-1/2 times the width of joint, or 3/4" minimum, whichever is greater. If sound mortar is not reached at a depth of 1-1/2", confer with Consultant on required tuckpointing depth. The base bid shall be 1.5" in depth.

- B. Square shoulder all cuts. Ensure all mortar is removed from brick surfaces within the joints.
- C. Exercise care when removing mortar to prevent damage to brick faces or edges. All masonry units damaged during mortar removal shall be removed and replaced with matching units, at the Contractor's expense.
- D. Remove mortar from joints using hand tools only. Mechanical tools will be permitted only on specific written approval of the Construction Consultant and demonstrated ability by operators to use tools without damage to masonry.
- E. Clean joints of all dirt and debris and rinse clean. Leave damp immediately prior to installing pointing mortar.
- F. Fill joint with mortar type specified.
- G. Install mortar in 1/4" deep layers until full depth of cut is reached, ensuring a densified placement of mortar. Do not leave voids or gaps in installation. Compact and tool each layer as placed. Maximum depth of pointing on a given day shall be 3/4".
- H. Tool exterior joints when "thumb print" hard. Joints shall be tooled flush to match existing, using a jointer at least 1'-0" in length for bed joints, and appropriate tool for head joints. Pointing mortar for exterior joints shall be in color matching existing mortar.
- I. When mortar reaches green state, cut and lightly brush mortar with a soft bristle brush to seal edges and remove excess mortar and droppings.
- J. Mask off lower stone wall areas to prevent mortar droppings from rebounding or splattering walls. Cover all roof areas and sidewalks to prevent staining. Remove stains and repair or replace damage from staining.
- K. Immediately remove and dry clean all misplaced and excess mortar and residue from faces of units using stiff bristle brush.
- L. If shrinkage cracking develops within the newly installed mortar due to rapid drying, installed mortar should be lightly tempered with a fine spray of water by means of a garden sprayer.

3.02 CLEANING: REFER TO SPECIFICATION SECTION 04 2000 UNIT MASONRY

3.03 SITE CLEANUP:

- A. Perform site cleanup as specified elsewhere.
- B. Return landscaping to similar condition prior to start of project.

3.04 CAUTION:

- A. Two of the most common mistakes in tuckpointing are:
 - 1. Using a mortar that has not been prehydrated, resulting in many shrinkage cracks.
 - 2. Using a mortar that is "too wet" resulting in excess mortar smear on the masonry wall face, requiring harsh excessive cleaning.
- B. Skilled mechanics and approved mockups are required to avoid these problems.

END OF SECTION

**SECTION 047200
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone. Wet Cast only, dry cast is not permitted.
 - 1. All items referred to as "Cast Stone" on the drawings

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast in Place Concrete: Installation of cast stone in conjunction with Concrete Tie Beams.
- B. Section 042000 - Unit Masonry: Installation of Cast Stone in conjunction with masonry.
- C. Section 079005 - Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.
- D. Section 07 6526 - Self-Adhering Sheet Flashing.

1.03 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- C. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
- E. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.
- F. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2025.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.
- K. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- L. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.
- M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- N. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.
- C. Product Data: Test results of cast stone components made previously by the manufacturer.
 - 1. Include one copy of ASTM C1364 for Architect's use.
- D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

1. Provide Florida licensed structural engineer's stamp on drawings.
 2. The cast stone manufacturer shall provide and be responsible for all cast stone engineering design including support connections, anchors, wall ties, internal reinforcement and method of attachment to building substrate / structural steel / metal stud framing, etc.
 3. Reuse of Architect's drawings for shop drawings is not allowed.
- E. Design Calculations: Stamped by a Professional Engineer licensed in the state where the project is located.
- F. Mortar Color Selection Samples - refer to Specification Section 04 2000 - Unit Masonry.
- G. Verification Samples: Pieces of actual cast stone components not less than 12 inches (305 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.
1. Prior to ordering materials, the Contractor shall receive written approval of color selection from the Owner and Architect.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
 2. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
 3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. Comply with the requirements of the Cast Stone Institute Technical Manual.
1. Maintain one copy of manual onsite.
- C. Professional Engineer Qualifications: Licensed in the state in which the project is located, experienced in the design of free-spanning and anchored stone elements.

1.06 MOCK-UP

- A. See Section 014000 - Quality Requirements for additional requirements.
1. Approved mock-up will become standard for appearance and workmanship.
 2. Mock-up may not remain as part of the completed work.
 3. Remove mock-up not incorporated into the work and dispose of debris.
- B. Comply with the requirements of the Cast Stone Institute Technical Manual.
1. Maintain one copy of manual on site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

1.08 DESIGN REQUIREMENTS

- A. Engage a licensed Professional Engineer, retained by the General Contractor, to design free-spanning cast stone elements and to engineer anchorage and attachment methods to structural framing, concrete beams, steel lintels or backup walls.
- B. Design shall include:
 - 1. All support and anchorage details.
 - 2. Calculations demonstrating compliance with applicable codes and load requirements.
 - 3. Prevention of cracking or deflection beyond acceptable tolerances.
 - 4. Design loads per codes indicated in the drawings.

PART 2 PRODUCTS

2.01 ARCHITECTURAL CAST STONE

- A. As a condition of bidding, the Cast Stone manufacturer must affirm that the supports on the drawings are able to be constructed and that any spanning/structural requirements of the cast stone are contemplated and included in the bidder's scope.
- B. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural stone, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 3. Surface Texture:
 - a. Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet (6 meters).
 - b. Provide smooth finish as indicated on the drawings.
 - 4. Color: Selected by Owner and Architect from manufacturer's full range.
 - 5. Remove cement film from exposed surfaces before packaging for shipment.
- C. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- D. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318. Provide design for connections to structure.

2.02 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Units: Type I, white or gray as required to match Owner and Architect's sample.
 - 2. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.
- E. Admixtures: ASTM C494/C494M.
- F. Water: Potable.
- G. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

- I. Embedded Anchors, Dowels, and Inserts: standard building stone anchors available in a non-corrosive materials such as stainless steel Type 302 or 304., of type and size as required for conditions.
- J. Provide Reinforcement and Anchorage as called for in Unit Masonry 04 2000 and as identified by General Contractor's structural engineer for horizontal joint reinforcement back to structural support.
- K. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.
- L. Mortar: Portland cement-lime, ASTM C 270 Type N ; do not use masonry cement.
- M. Sealant: As specified in Section 079005.
- N. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 042000.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- D. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.
 - 1. Provide sealant & backer rod in all joints per manufacturer's requirements. Refer to section 07 9005.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
 - 4. Leave the following joints open for sealant:
- E. Sealant Joints: Install sealants as specified in Section 079005.
- F. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 10 feet (3 m).
 - 1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
- G. Weep Installation:
 - 1. At cast stone provide weeps as recommended by manufacturer. Assure that weep is open and is capable of allowing release of wall cavity moisture away from wall cavity to exterior face. Install in accordance with the cast stone institute technical manual - current edition.
 - 2. Place weeps as shown on drawings and above thru-wall flexible flashing at 18" on center horizontally, and in accordance with manufacturer's instructions and recommendations.
 - 3. Provide cavity mortar control per Section 04 2000 Unit Masonry.
 - 4. Provide thru wall flashing per Section 07 6526 Self-Adhering Sheet Flashing.

5. Design of connections not detailed shall be on the shop drawings and stamped by a Florida licensed manufacturers specialty engineer for review of architect's structural engineer.
6. Design anchors and supports under direct supervision of a Professional Structural Engineer, registered in the State in which the Project is located.
 - a. Design anchors to resist positive and negative wind pressures and other loads as required by applicable code.
 - b. Design anchor attachment to stone with a factor of safety of 5:1.
 - c. Design each individual anchor with a factor of safety in the vertical dead-load-bearing direction of 4:1 and in the horizontal lateral-load-bearing direction of 2:1.
7. Anchoring: The General Contractor shall be responsible for all anchoring and fastening of the all cast stone elements for a code-compliant installation.

3.03 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 1. Wet surfaces with water before applying cleaner.
 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 4. Do not use acidic cleaners.

3.04 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.
- C. Protect from soil stains during construction.

3.05 ANCHORAGE AND STRUCTURAL DESIGN

- A. Anchorage design shall be by a Professional Engineer licensed in the state of installation.
- B. Engineer shall design:
 1. All free-spanning elements to resist applied loads and self-weight.
 2. All attachments to structural frame or backup system.
 3. Corrosion-resistant connection hardware.
 4. Submit sealed design drawings and calculations for review prior to fabrication.

END OF SECTION

**SECTION 051200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Base plates, shear stud connectors and expansion joint plates.
- C. Grouting under base plates.
- D. **Refer to Structural Drawings for additional requirements.**

1.02 RELATED REQUIREMENTS

- A. Section 053100 - Steel Decking: Support framing for small openings in deck.
- B. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2026).
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- G. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2024.
- H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- I. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- J. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- K. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- L. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).
- M. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2024.
- N. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.
- O. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
- P. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.
- Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Indicate cambers and loads.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
4. Delegated Design Submittal: For structural steel connections indicated on drawings to comply with design loads, include calculations signed and sealed by the qualified professional engineer responsible for their preparation. **Reference the Structural Drawings for additional information**

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Maintain one copy of each document on site.
- C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.
- D. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. For material grades of various structural shapes and fasteners, **reference the Structural Drawings.**
- B. Load Indicator Washers: Provide washers complying with ASTM F959 at connections requiring high-strength bolts.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
- E. Shop and Touch-Up Primer: Basis of Design; Tnemec Series 90-97 Tneme-Zinc applied at 2.5-3.5 mils DFT. **Refer to Section 09 9601 High-Performance Coatings.**
- F. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Develop required camber for members.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing and analysis of structural steel. **Refer to the Structural Drawings for schedule of Special Inspections and Tests.**
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.03 ERECTION

- A. Erect structural steel in compliance with AISC S303 "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Architect.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.
 1. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 2. 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.
 3. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 1. 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.
 - a. Clean and prepare surfaces by SSPC-SP 11 Power Tool Cleaning to Bare Metal.
 2. Cleaning and touchup painting are specified in Sections 099113 "Exterior Painting", Section 099123 "Interior Painting", and Section 099600 "High-Performance Coatings", as applicable.
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.05 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.06 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", testing at least 25 percent of bolts at each connection. Visually inspect all bolts for snug tight condition.
- C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

**SECTION 051330
ALUMINUM LADDERS AND ALUMINUM ROOF HATCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Ships Stair.
- B. Aluminum Roof Hatch with integral curbs and guard rail system.

1.02 RELATED SECTION

- A. Section 06 1000 - Rough Carpentry.
- B. Section 05 4000 - Cold-Formed Metal Framing.
- C. Section 05 5000 - Metal Fabrications.
- D. Section 07 5410 - Thermoplastic Polyolen Roofing.
- E. Section 05 1200 - Structural Steel Framing - Roof Structure & Opening Support.
- F. Section 09 9113 - Exterior Painting.

1.03 REFERENCES

- A. OSHA 1910.25: Stairways
- B. OSHA 1910.28: Duty to have fall protection and falling object protection.
- C. OSHA 1910.29: Fall protection systems and falling object protection-criteria and practices.
- D. IBC 2015.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 3000.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings for Ladders:
 - 1. Plan and section of stair installation.
 - 2. Plan and section of aluminum roof hatches. Indicate rough opening dimensions for ceiling, roof openings, and roof hatch size.
 - 3. Plan and section of aluminum Gaurd Rail system installation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store stairway until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.06 WARRANTY

- A. Limited Warranty: Five (5) years against defective material and workmanship, covering parts only, no labor or freight. Defective parts will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Precision Ladders, LLC, which is located at: P. O. Box 2279; Morristown, TN 37816-2279; Toll Free Tel: 800-225-7814; Tel: 423-586-2265; Email: info@PrecisionLadders.com; Web: www.PrecisionLadders.com , Emack Slate 205-879-3424 or equal.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 6310.

2.02 ALUMINUM SHIPS STAIR

- A. Aluminum Ships Stair and Components: Stair, mounting brackets and handrails on both sides.
 - 1. Model: SL-02 (149.75" = height in vertical inches) Aluminum Ships Stair as manufactured by Precision Ladders, LLC. **Job verify all dimensions and conditions prior to order.**
 - 2. Width: 36"
 - 3. Capacity: Unit shall support a 1,000 lb (454 kg) total load without failure.
 - 4. Degree of Incline: 63 degrees.
 - 5. Performance Standard: Units designed and manufactured to meet or exceed OSHA 1910.25.
- B. Components:
 - 1. Stair Stringer: [5] inch ([127] mm) by 2 inch by 3/16 inch (127 mm by 51 mm by 5 mm) extruded 6005-T5 aluminum channel.
 - 2. Stair Treads: [5-3/16] inch ([132] mm) by 1-1/8 inch by 1/8 inch (131 mm by 29 mm by 3 mm) extruded 6005-T5 aluminum with serrated slip resistance surface standard. [1-1/4] inch ([32] mm) by 1-1/4 by [1-1/4] inch ([32] mm) angle welded to underside of treads. Treads shall be welded and bolted to stringer with 1/4" stainless steel bolts.
 - 3. Stair Mounting Brackets:
 - a. Floor Brackets: [2] inch ([50.8] mm) by 3 inch by 1/4 inch (51 mm by 76 mm by 6 mm) aluminum angle.
 - b. Top Bracket: [4-3/4] inch ([121] mm) by 5 inch by 1/4 inch (121 mm by 127 mm by 6 mm) aluminum angle.
 - 4. Handrails: [1-1/4] inches ([32] mm) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.
 - 5. Platform:
 - a. Surface: Platforms 9 Sq Ft or less shall be made of standard tread material. Platforms larger than 9 Sq Ft shall have a bar grating surface.
 - b. Toe Boards: [4] inch ([101.6] mm) by 1/4" 6005 T-5 aluminum.
 - c. Handrails: [1-1/4] inches ([32] mm) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.
 - 6. Finishes:
 - a. Standard: Mill finish on aluminum stair components.
 - b. Optional Finishes
 - 1) Powder Coated
 - 2) Clear Anodized

2.03 ALUMINUM ROOF HATCHES

- A. **Basis of Design:** (Model PH-A) Equal to Precision Ladders LLC. Minimum size of 3'-0" x 5'-0". Size Roof hatch for fixed vertical wall ladder accordingly. **Refer to drawings for location.** GC to provide concealed solid wood blocking in wall cavity at each location of manufacturer's ladder brackets.
- B. Performance Characteristics
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 0.67% of the span and a 20 psf wind uplift.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- C. Curb
 - 1. Formed from 0.090 Aluminum H-14 3003.
 - 2. Sheathed with 1 inch of rigid fiber board insulation.
 - 3. Height of 12 inches minimum unless required to be higher for roofing manufacturer's warranty. Contractor to coordinate height of all curbs to comply with roofing manufacturer's warranty requirements.

4. 4 inch integral flange for securing to roof.
 5. Hinges connecting curb to door shall be 1/8 inch, 2 piece formed steel with 3/8 inch pivot pin.
 6. Extruded rubber gasket within a 20 gauge extruded aluminum track shall be securely attached to the frame to make the unit weathertight.
- D. Cover
1. Formed from 0.090 Aluminum H-14 3003.
 2. Liner shall be 0.040 Aluminum H-14 3003.
 3. Insulation between cover and liner to be 1" thick U.L. plain fiberglass 0.75# density.
 4. Lid shall be reinforced as required with 0.090 Aluminum H-14 3003 on aluminum models.
 5. A one point cab lock is to be provided with a built-in inside handle on units with a length of 4' 6" or less. On units of greater length, a 2 point slam lock will be used.
 6. Exterior of cover shall be devoid of hardware with the exception of the outside handle.
 7. Outside handle shall be vinyl coated, steel T-handle.
 8. Automatic hold-open device shall be formed from 3/16" steel flat bar and 1/2" diameter steel round stock with a vinyl grip.
 9. Padlock provisions provided on both interior and exterior of unit.
 10. Extruded rubber gasket shall be securely attached to the liner, thus providing a weather-tight seal.
- E. Pressure Control
1. Opening/closing assistance/resistance shall be provided with spring-loaded pressure intensifiers consisting of a telescoping tube; the top(outer) tube shall be 1 5/16", bottom (inner) tube shall be 1 1/2". Tubes shall be cadmium plated and chromate-sealed.
- F. Hardware
1. Provide corrosion resistant hardware and fasteners.
- G. Finish
1. Mill Finish Aluminum

2.04 ALUMINUM GAURD RAIL SYSTEM

- A. Aluminum gaurd rail system and components: vertical and horizontal rails, mounting brackets, self-closing gate, hardware, and finishes.
- B. **Basis of Design:** Model AGRS-H by Precision Ladders LLC.
- C. Capacity: System shall support a load of 200 lbs applied in any direction.
- D. Performance: Unit shall comply with OSHA 1910.28 and OSHA 1910.29.
- E. Components:
1. Vertical and horizontal rails: Aluminum (6005-T5) 1-1/4" (32 mm) schedule 40 pipe with 1-5/8" (42 mm) OD.
 2. Brackets: Y style 5" x 1-1/4" x 1/8" (127 mm by 32 mm by 4 mm) aluminum square tubing.
 3. Self-closing gate: Aluminum (6005-T5) 1-1/4" (32 mm) schedule 40 pipe with 1-5/8" (42 mm) OD hinged on open side.
 4. Hardware: Corrosion resistant hardware and fasteners is standard.
 5. Finish: Mill finish aluminum

2.05 SAFETY POST

- A. Provide retractable post for entering and exiting the roof hatches. Mount post to hatch access ships stair. Equal to Extend-A-Rail Modeby Precision Ladders LLC.

2.06 FABRICATION

- A. Completly fabricate stair ready for installtion before shipment to site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.
- C. Verify vertical distance and other job conditions prior to manufacture.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. The final installation to be inspected by manufacturer's representative and certified as code compliant and approved.
- C. Top tread of stair level with base of hatch; job verify.
- D. Provide P.T. Wood Blocking under Roof Hatch Curb to accomodate thickness of rigid roof insulation.
- E. Provide sealants per Section 07-9005 Joint Sealants for a waterproof installation at all fasteners and penetrations.

3.03 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.04 WARRANTY

- A. 5 year manufacturer warranty.

END OF SECTION

**SECTION 052100
STEEL JOIST FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for floor and roof openings greater than 18 inches (450 mm).

1.02 RELATED REQUIREMENTS

- A. Section 042000 - Unit Masonry
- B. Section 051200 - Structural Steel Framing: Superstructure framing.
- C. Section 053100 - Steel Decking: Bearing plates and angles.
- D. Section 053100 - Steel Decking: Support framing for openings less than 18 inches (450 mm) in decking.
- E. Section 055400 - Cold Form Metal Framing
- F. Section 055000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

- A. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- E. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).
- F. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.
- G. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
- H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2026.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
- J. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.
- K. SJI (SPEC) - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.
- L. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2025.
- M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- N. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).
- O. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
 - 1. Reference Structural Drawings for Delegated Design requirements for joists with special loading.

- C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI (SPEC) Standard Specifications Load Tables and SJI Technical Digest No. 9.
 - 1. Maintain one copy of document on site.
- B. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
 - 1. Canam Group Inc: www.canam-steeljoists.ws
 - 2. CMC Joist: www.cmcjoist.com.
 - 3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 - 4. New Millenium: <https://www.newmill.com/>
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Open Web Joists: Refer to Structural drawings and notes :
 - 1. Provide bottom chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: As shown on the drawings.
 - 3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
 - 4. End bearing of 4 inches (100 mm) on masonry supports, unless shown otherwise.
 - 5. Finish: Shop primed.
- B. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A 36/A 36M.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
- B. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/240 of the span.

2.04 FABRICATION

- A. Frame special sized openings in joist web framing, if indicated.
- B. Steel Joist
 - 1. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - a. Joist Type: K-series
 - b. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
 - c. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."

- d. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."

2.05 FINISH

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Position and field weld joist chord extensions and wall attachments as detailed.
- F. Install supplementary framing for floor and roof openings greater than 8 inches (<> mm), unless shown otherwise on drawings.
- G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- H. Do not field cut or alter structural members without approval of joist manufacturer.
- I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed, except surfaces specified not to be primed.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least ____ percent of bolts at each connection.
- C. Welded Connections: Visually inspect all field-welded connections and test at least ____ percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

**SECTION 053100
STEEL DECKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof decking.
- B. Supplementary framing for openings up to and including 18 inches (450 mm).
- C. Bearing plates and angles.
- D. **Refer to Structural Drawings for additional requirements.**

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete topping over metal deck.
- B. Section 042000 - Unit Masonry: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- C. Section 051200 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- D. Section 055000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
- G. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).
- H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- J. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).
- K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Certificates: Certify that products furnished meet or exceed specified requirements.
- E. Submit manufacturer's installation instructions.
- F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints in accordance with manufacturers written recommendations in and for the the State in which the Project is located for project conditions.
- B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Canam Steel Corporation; ____: www.canam-steeljoists.ws.
 - 2. Nucor-Vulcraft Group; ____: www.vulcraft.com/#sle.
 - 3. Wheeling Corrugating Co: www.wheelingcorrugating.com.
 - 4. New Millenium: <https://www.newmill.com/>
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
 - 2. Maximum Vertical Deflection of Floor Deck: 1/360 of span.
- B. Roof Decking: There are two (2) different types of roof decking used in this project - **Refer to the Structural Drawings.**
 - 1. High Roof Deck A - Galvanize and shop prime Basis of Design; Tnemec Series 161 Tneme-Fascure or compatible primer. **Refer to Section 09 9601 High-Performance Coatings and structural drawings**

2.03 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steelunfinished.
- B. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.
- C. Welding Materials: AWS D1.1/D1.1M.
- D. Fasteners: Galvanized hardened steel, self tapping and power-actuated fasteners.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- F. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.
- G. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

2.04 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, shall match gage and finish of associated roof deck.

PART 3 EXECUTION

3.01 EXAMINATION

- A. **Verify existing conditions prior to beginning work.**

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.
- C. On steel supports provide minimum 2 inch bearing.

- D. Weld deck in accordance with AWS D1.3/D1.3M.
- E. **Reference Structural drawings for Deck fasteners & attachment patterns.**
- F. At deck openings from 6 inches (150 mm) to 18 inches (450 mm) in size, provide 2x2x1/4 (50 by 50 by 6mm) steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- G. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- H. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- I. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- J. Weld stud shear connectors through steel deck to structural members below.
- K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.03 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
 - 1. Repair rust spots, welds, and abraded areas on exposed surfaces of prime-painted deck immediately after installation per SSPC SP3, and apply repair paint.
 - 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION

**SECTION 054000
COLD-FORMED METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Exterior sheathing (gypsum sheathing) in locations where sheathing attaches to cold form framing (not on wood).
- C. Formed steel joist, purlin, and rafter framing and bridging as indicated on drawings. **Provide additional framing as required for installation of aluminum ships stairs and roof hatches per manufacturer's instructions.**
- D. Formed steel
- E. **Refer to Structural drawings for additional requirements.**

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry
- B. Section 05 1330 - Aluminum Ladders and Roof Hatches
- C. Section 053100 - Steel Decking.
- D. Section 061000 - Rough Carpentry: Wood blocking and miscellaneous framing.
- E. Section 07 2726 - Fluid Applied Membrane Air Barrier.
- F. Section 079005 - Joint Sealers.
- G. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.
- F. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2024.
- G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
- J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, and limitations.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud.
 - 2. Describe method for securing studs to tracks and for bolted framing connections.
 - 3. Provide details and calculations for factory-made framing connectors.
 - 4. All shop drawings, details, and calculations to be stamped by an Florida Licensed Professional Engineer.
 - a. Note: Delegated Design Engineer to provide stamped calculations package for all cold-formed steel framing components subject to live loads, wind loads, or other component loading indicated on Contract Drawings.
- D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.06 MOCK-UP

- A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish
- B. Location: **As directed by Architect.**
- C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino; ____: www.marinoware.com/#sle.
 - 3. The Steel Network, Inc; ____: www.SteelNetwork.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Deliver to site in largest practical sections.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
- B. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
 - 1. Gage and Depth: As scheduled.
- C. Joists and Purlins: Fabricated from ASTM A1008/A1008M Designation SS (structural steel) sheet, shop painted.
 - 1. Finish: Manufacturer's standard, rust-inhibitive paint.
- D. Framing Connectors: Factory-made, formed steel sheet.

1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
4. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.
5. Rafters: Unpunched structural studs with properties indicated on drawings.

2.04 WALL SHEATHING (GYPSUM SHEATHING)

- A. Sheathing: Glass mat faced gypsum; ASTM C 1177/C 1177M, square, 5/8 inch Type X fire-resistant (16 mm Type X fire-resistant). Comply with all governing authorities.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, match stud thickness unless noted on drawings; finish to match framing components.
- B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.06 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Anchorage Devices: Power actuated.
- D. Welding: In conformance with AWS D1.1, when noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- D. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- E. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- F. Install intermediate studs above and below openings to align with wall stud spacing.
- G. Attach cross studs to studs for attachment of fixtures anchored to walls.

- H. Install framing between studs for attachment of mechanical and electrical items, and bridging to prevent stud rotation and buckling.
- I. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS, PURLINS, AND RAFTERS

- A. Install framing components in accordance with manufacturer's instructions and drawings.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.04 WALL SHEATHING (GYPSUM SHEATHING)

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
 - 1. Provide steel diagonal bracing at corners.

END OF SECTION

**SECTION 055000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1330 - Aluminum Ladders and Aluminum Roof Hatches
- D. Section 099113 - Exterior Painting: Paint finish.
- E. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders - Fixed - Safety Requirements; 2008 (Reaffirmed 2018).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- H. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.
- M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
- O. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.

1.08 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Fasteners:
 1. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
 2. 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.
 3. Anchor Bolts: ASTM F 1554, Grade 36.
 4. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
 5. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 6. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
 7. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
 8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

- a. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Subparagraph above and below are examples only. Above protects against corrosion in an indoor atmosphere. Revise to suit other conditions after verifying availability of thicker coatings.
 - c. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).
9. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.
- H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

1.09 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

1.10 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- B. Lintels: As detailed; hot dippedgalvanized finish.
- C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

1.11 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1.12 FINISHES - STEEL

- A. Prime steel items: Basis of Design; Series 90-97 Tneme-Zinc at 2.5-3.5 mils DFT - **Refer to Section 09 9601 High Performance Coatings.**
- B. Prepare surfaces to be primed in accordance with SSPC SP 10/Nace 2 Near White Metal Blasting
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

1.13 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

2.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

2.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

2.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

**SECTION 061000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-structural dimension lumber framing.
- B. Rough opening framing for doors, windows, and roof openings.
- C. Concealed blocking for miscellaneous items.
- D. Roof-mounted curbs.
- E. Roofing nailers.
- F. Preservative treated wood materials.
- G. Fire retardant treated wood materials.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 033000 - Cast-in-Place Concrete: Setting anchors in concrete.
- C. Section 04200 - Unit Masonry
- D. Section 051200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- E. Section 055000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- F. Section 072726 - Fluid Applied Membrane Air Barriers
- G. Section 076200 - Sheet Metal Flashing and Trim:

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- F. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- I. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.
- J. AWWA U1 - Use Category System: User Specification for Treated Wood; 2025.
- K. PS 1 - Structural Plywood; 2023.
- L. PS 20 - American Softwood Lumber Standard; 2025.
- M. SPIB (GR) - Standard Grading Rules; 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Samples: For rough carpentry members that will be exposed to view, submit two samples, 12by12 inch (.by. mm) in size illustrating wood grain, color, and general appearance.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 4. Exterior grade Fire Retardant dimensional Lumber for framing and blocking.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):
 - 1. Species: Southern Pine.
 - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Fire-Retardant Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Fire Rated Exterior grade plywood. Refer to drawings for additional information.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: as required for secure fastening per industry standards. .
- B. Sill Gasket on slab below pressure treated 2x6 sill plate): 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 - 1. Manufacturers:
 - a. Lonza Group; ____: www.wolmanizedwood.com/#sle.
 - b. Hoover Treated Wood Products, Inc; ____: www.frtw.com/#sle.
 - c. Koppers, Inc; ____: www.koppersperformancechemicals.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Do not use treated wood in direct contact with the ground.
 - 3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 - 1. Manufacturers:
 - a. Lonza Group; ____: www.wolmanizedwood.com/#sle.
 - b. Koppers Performance Chemicals, Inc; ____: www.koppersperformancechemicals.com/#sle.
 - c. Viance, LLC; ____: www.treatedwood.com.
 - d. Osmose, Inc: www.osmose.com.
 - e. Substitutions: See Section 016000 - Product Requirements.
 - 2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing, flashing, or waterproofing.
 - c. Treat lumber in contact with masonry or concrete.
 - 3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.

- a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
- b. Treat plywood in contact with roofing, flashing, or waterproofing.
- c. Treat plywood in contact with masonry or concrete.
- d. Treat plywood less than 18 inches (450 mm) above grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and IBC 2016.
- E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Provide bridging at joists in excess of 8 feet (2.3 m) span as detailed. Fit solid blocking at ends of members.
- H. Extend all interior bearing non-bearing stud framing from floor to structure above.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Specifically, provide the following non-structural concealed framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
 - 10. Interior Wall Plaques
 - 11. Mirror attachment clips.
 - 12. Acoustical Wall Panels.
 - 13. Audio/Visual Equipment
 - 14. Electrical Equipment/Fixtures/Panels
 - 15. Mechanical
 - 16. Plumbing Equipment/Fixtures
 - 17. Vertical and Horizontal Wall Guards

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation. See drawings.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.
- C. Provide "H" clips in roof decking in size, quantity, and location as recommended by manufacturer.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

3.08 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 017419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 062000
FINISH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plastic laminate wall panels.
 - 1. **See Section 06 4100 - Architectural Plastic Laminate Casework for Laminate Materials and additional instructions.**
- B. Solid wood trim at plastic laminate casework and wall panels.
 - 1. Wood door frames, glazed frames.
 - 2. Hardware and attachment accessories.
 - 3. Finishes
 - a. Site Finish: Refer to finish schedule for color of transparent finish and opaque finishes.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Plastic Laminate Casework
- C. Section 099123 - Interior Painting: Painting and finishing of finish carpentry items.
- D. Section 12 3600 - Countertops

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2004.
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- F. 2009 International Mechanical Code

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on fire retardant treatment materials and application instructions.
 - 2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of finished wood trim 12 inch (<> mm) long and 12 inch x 12 inch plywood panel with plastic laminate finish.

1.06 MOCK-UP

- A. Construct a plastic laminate paneling with solid wood mock-up sized and located as directed; provide wood panels, trim, laminates, finishes, and other materials.
- B. If approved, the mockup may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by all applicable codes.

2.02 LUMBER MATERIALS

- A. Solid Wood Trim: Maple trim with transparent finish for plastic laminate casework and wall panels: Maple species, premium grade sawn, maximum moisture content of 6 percent . Refer to drawings for details for other interior transparent wood trim. Provide in maximum lengths. Refer to Section 09 9123 Interior Paint Specification and the Finish Schedule.
 - 1. Provide maple plugs, min. 1/4 inch deep, to cover countersunk wood screws. Sand off smooth prior to applying transparent finish.
 - 2. Provide wood trim with outside corners having a 1/8 inch radius eased edge. Sand to remove all machine marks.
- B. Available at Marshall Lumber Company 334-263-0525. or equal.

2.03 SHEET MATERIALS

- A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- B. Particleboard Substrate/Core: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces. **Class A with flame spread of 25; less smoke development of 0-450.**
- C. Cores in wet areas to be moisture resistant.
- D. All veneers to be factory fused to core materials by manufacturer.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds. Comply with all applicable environmental regulations.
- B. Fasteners: Of size and type to suit application; chrome finish in concealed locations. ____

2.05 HARDWARE

- A. For cabinet hardware this section refer to Section 06 4100 Architectural Wood Casework para 2.06 requirements

2.06 WOOD CABINETS FOR PLASTIC LAMINATE FINISH

- A. Refer to Section 06 4100 - Architectural Wood Casework.

2.07 WOOD TREATMENT

- A. **Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84**
- B. Provide identification on fire retardant treated material.
- C. Redry wood after pressure treatment to maximum ____ percent moisture content.

2.08 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood (9 mm matching hardwood) edging. Use one piece for full length only.

- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- D. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.09 FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
- C. See Section 06 1000 Rough Carpentry for installation of concealed wood blocking.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
- D. Install hardware in accordance with manufacturer's written instructions.
- E. Install solid surface materials in strict accordance with manufacturer's instructions.
- F. Install plastic laminate panels vertically per manufacturer's instructions.
- G. Install with concealed fasteners.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 099113 and 099123.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

**SECTION 064100
ARCHITECTURAL PLASTIC LAMINATE CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinet hardware.
- B. Preparation for installing utilities.
- C. Plastic Laminate Casework

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements.
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 01 7419 - Construction Waste Management and Disposal
- D. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- E. Section 06 2000 - Finished Carpentry., for solid wood trim, Maple.
- F. Section 12 3600 - Countertops

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- C. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- D. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards; Revision A, 1996.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot (1:8).
- B. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- C. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of Architectural Plastic Laminate Casework for this Project.

1.07 MOCK-UP

- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

1.10 WARRANTY

- A. 10 year written warranty on all products in this section for full replacement due to failure.

1.11 MANUFACTURER QUALIFICATION

- A. Reputable manufacturer with documented experience manufacturing cabinets of equal size, quantity, scope, and quality for a period of not less than 5 years.

PART 2 PRODUCTS

2.01 CABINETS

- A. Plastic Laminate Faced Cabinets: Custom grade.
- B. Cabinets as indicated on drawings:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Concealed Surfaces: Manufacturer's laminate option.
 - 4. Door edges, Drawer edges, Front of cabinet edges, Shelves edges, and Cabinet Face Profiles: 3 mm thick, factory adhered.
 - 5. Casework Construction Type: Type A - Frameless.
 - 6. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
 - 7. Cabinet Design Series: As indicated on drawings.
 - 8. Adjustable Shelf Loading: 50 lbs. per sq. ft..
 - a. Deflection: L/144.
 - 9. Cabinet Doors and Drawer Fronts: Flush style.
 - 10. Drawer Side Construction: Dowel or dovetail sides, sub fronts, and backs together. Submit sample with Mock up.
 - 11. Drawer bottoms to be dadoed into sides, sub fronts, and backs.
 - 12. Refer to finish schedule on the drawings for color selection.
 - 13. Casework components to be constructed of laminate faced plywood or Industrial particle board. Provide 3/4 inch thick marine plywood separate bases and marine plywood sub-tops for support of tops specified in 12 3600.

2.02 SOLID WOOD TRIM COMPONENTS:

- A. Refer to Section 06 2000 Finish Carpentry

2.03 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation: www.formica.com. (Basis of Design)
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thermally Fused Laminate (TFL): NEMA LD 3, Type VGL laminate panels.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- D. Provide specific types as scheduled.
 - 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, colors as scheduled, finish as scheduled.
 - 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, colors as scheduled, finish as scheduled.
 - 3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.

4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 COUNTERTOPS

- A. Refer to Section 12 3600 & the Drawings.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application. Provide 10 year adhesion - full replacement warranty on all laminated products should any laminations come unlaminated due to natural wear. Comply with all environmental requirements.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self-locking serrated tongue; of width to match component thickness.
 1. Color: As selected by the architect and owner from manufacturer's standard range (Intent is to match the adjoining plastic laminate as closely as possible).
 2. Use at **3mm thick** at all cabinet faces, doors, drawer fronts, and exposed edges.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Grommets: Stainless steel grommets for cut-outs. For bidding purposes, calculate at least one per individual work surface unless noted otherwise. The actual locations must be approved by the owner. See drawings.
- F. Counter top bracket supports: Painted steel, per manufactures standard, comply with ADA

2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, stainless steel brushed finish , 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers)
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, stainless steel brushed finish. Provide in locations if shown on drawings.
- E. Drawer Slides:
 1. Type: Full extension, soft close.
 2. Static Load Capacity: Commercial grade.
 3. Mounting: Side mounted. provide screws in all drawer guide holes.
 4. Stops: Integral type.
 5. Features: Provide self closing / soft close / stay closed type. (provide actual guide in mock up cabinet)
 6. Provide manufacturers recommended screws in all drawer guide screw holes.
 7. Products:
 - a. Accuride International, Inc: www.accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Hettich America, LP: www.hettichamerica.com.
 - d. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- F. Hinges: five knuckle grade 1, 270 degrees - stainless steel brushed finish , (provide actual hinge in cabinet mock up), provide manufactures recommended screws in all hinge screw holes.
- G. Door Catches: Nylon roller spring catch, dual or self aligning.

2.07 SITE FINISHING MATERIALS

- A. Finishing of Wood trim: Site finished as specified in Section 09 9123 Interior Painting and Section 06 2000 Finished Carpentry

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.09 MANUFACTURERS/PRODUCTS:

- A. Acceptable Products: Custom Grade per AWI
 - 1. Stevens Industries 1200 Series Cabinets, LSI Cabinets, Cases systems Cabinets, TMI cabinets, , Alco Enterprises Inc., Varner Woodworks, Phipps Cabinets, Jimco Inc. All listed must meet all requirements in this specification and drawings.
- B. 10 year written warranty on all products in this specification for full replacement due to failure.
 - 1. Substitutions: See 016000 - Product Requirements

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing prior to installation.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- G. Coordinate with Counter top requirements.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

**SECTION 068316
FIBERGLASS REINFORCED PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.
- C. Sani Stainless Steel Cove Base or equal

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 042000 - Unit Masonry
- C. Section 09 2116 - Gypsum Board Assemblies
 - 1. **Provide mold resistant gypsum wall board behind fiberglass reinforced paneling.**

1.03 REFERENCE STANDARDS

- A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation; current edition.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2026.
- C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2025.
- D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- E. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- G. FDA Food Code - Chapter 6 - Physical Facilities; Current Edition.
- H. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.
- I. ISO 846 - Plastics - Evaluation of the Action of Microorganisms; 2019.
- J. ISO 2812-1 - Paints and Varnishes -- Determination of Resistance to Liquids -- Part 1: Immersion in Liquids Other than Water; 2017.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples ____by____ inch (____x____ mm) in size illustrating material and surface design of panels.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Valto; _____: www.valtoem.com.com/#sle.
 - 2. Marlite, Inc; _____: www.marlite.com/#sle.
 - 3. Nudo Products, Inc; _____: www.nudo.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 10 feet (1.2 by 3.0 m).
 - 2. Panel Thickness: 0.09 inch (2.3 mm).
 - 3. Surface Design: Embossed.
 - 4. Color: As selected by Architect.
 - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Sanitation and Cleanability: Comply with 9 CFR 416.2.
 - 4. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
- B. Trim: Vinyl; color coordinating with panel.
- C. Cove Base - Wall to Floor Transitions: Equal to **Sani-Cove Base, Valto**. See finish schedule for specified locations. Submit product information and samples for approval.
- D. Adhesive: Type recommended by panel manufacturer for flooring specified. .
- E. Sealant: Type recommended by panel manufacturer; white.
- F. Provide all fasteners and accessories for full and complete installation of sani cove base.
- G. Provide premade corners at all 90 degree corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.
- C. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.
- D. Do not begin ceiling installation until services above ceiling are complete except for final trim

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions. Coordinate fit between FRP Wall Panels and sani cove base where applicable.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Pre-drill fastener holes in panels, 1/8 inch (3.2 mm) greater in diameter than fastener, spaced as indicated by panel manufacturer.
- D. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- E. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- F. Install panels with manufacturer's recommended gap for panel field and corner joints.
- G. Place trim on panel before fastening edges, as required.
- H. Fill channels in trim with sealant before attaching to panel.

- I. Install trim with adhesive and screws or nails, as required.
- J. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- K. Remove excess sealant after paneling is installed and prior to curing.
- L. For Sani Cove base, follow applicable guide by manufacturer. Terminate ends of cove base as recommended by manufacturer. Provide all necessary accessories for full and complete installation.

END OF SECTION

**SECTION 071113
BITUMINOUS DAMPPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry.
- B. Section 072100 - Thermal Insulation: Rigid insulation board used as protection board.
- C. Section 07 6526 - Self-Adhering Sheet Flashing.

1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).
- B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).
- C. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- D. ASTM D2822/D2822M - Standard Specification for Asphalt Roof Cement, Asbestos-Containing; 2005 (Reapproved 2011)e1.
- E. ASTM D3747 - Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation; 1979 (Reapproved 2007).
- F. ASTM D4022/D4022M - Standard Specification for Coal Tar Roof Cement, Asbestos Containing; 2007 (Reapproved 2012)e1.
- G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2024).
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.
- I. ASTM D5643/D5643M - Standard Specification for Coal Tar Roof Cement, Asbestos Free; 2006 (Reapproved 2024).
- J. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
- K. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Other Acceptable Bituminous Dampproofing Manufacturers:

1. Karnak Corporation; _____: www.karnakcorp.com/#sle.
2. Mar-Flex Systems, Inc; _____: www.mar-flex.com/#sle.
3. W.R. Meadows, Inc; _____: www.wrmeadows.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 1. VOC Content: Not more than permitted by local, State, and federal regulations.
 2. Applied Thickness: 30 mils, minimum, wet film.
 3. Products:
 - a. W.R. Meadows, Inc: Sealastic Type II, (brush on-spray grade) www.wrmeadows.com/#sle. ASTM 1187.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.03 COLD ASPHALTIC MATERIALS

- A. Bitumen: Asphalt emulsion, {rs#1}.
- B. Asphalt Primer: {rs#1}, compatible with substrate.
- C. Sealing Mastic: Asphalt roof cement, ASTM 1187, Type II.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 APPLICATION

- A. Patch disturbed areas of existing asphalt dampproofing with two coats of new dampproofing of the same generic type.
- B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- D. Apply bitumen with mop.
- E. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.
- F. Apply bitumen in one coat, continuous and uniform, at a rate of 25 sq ft/gal (0.6 sq m/L) per coat.
- G. Apply from 2 inches (50 mm) below finish grade elevation down to top of footings.
- H. Seal items watertight with mastic, that project through dampproofing surface.
- I. Immediately backfill against dampproofing to protect from damage.
- J. Pin holes in dampproofed surface are not acceptable.

END OF SECTION

**SECTION 071923
MASONRY CLEANER AND SILOXANE WATER REPELLENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Masonry Cleaner.
- B. Water repellants applied to exterior brick surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 04 2000 - Unit Masonry.
- C. **Refer to Demolition Notes on drawings for additional requirements.**

1.03 REFERENCE STANDARDS

- A. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.
- B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2013).
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Water Repellent Material: Two gallons (9 liters) of the type installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

- A. Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

1.07 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Biological and Atmospheric Stain Remover **for masonry walls.**
1. Product: Prosoco Enviro Klean Reclaim Cleaner.
 - a. Liquid cleaner and Activator Neutralize with solution of Sure Klean Limestone and Masonry after wash diluted 1:1 with clean water.
 2. ReKlaim Cleaner:
 - a. Form: Clear, light yellow liquid, soap odor.
 - b. Specific Gravity: 1.09.
 - c. pH: 13.7.
 - d. Wt/gal: 9.10 lbs.
 - e. Active Content: Not applicable.
 - f. Total Solids: Not applicable.
 - g. VOC Content: Not applicable.
 - h. Flash Point: >200 degrees F (>93 degrees C).
 - i. Freeze Point: 14 degrees F (-10 degrees C).
 - j. Shelf Life: 1 year in tightly sealed, unopened container.
 3. ReKlaim Activator:
 - a. Form: Clear, colorless liquid, slight odor.
 - b. Specific Gravity: 1.10.
 - c. pH: 2.40.
 - d. Wt/gal: 9.57 lbs.
 - e. Active Content: Not applicable.
 - f. Total solids: Not applicable.
 - g. VOC Content: Not applicable.
 - h. Flash Point: Not applicable.
 - i. Shelf Life: 1 year in tightly sealed, unopened container.
 4. Install per manufacturer's instructions to include but not limited to limitations and safety instructions.
- B. Silane, Siloxane, Silane-Siloxane Blend, and Silconate Water Repellants **for masonry walls:**
1. Product: PROSOCO, Inc; Sure Klean Weather Seal P.B: www.prosoco.com, or approved equal.
 2. Form: White milky liquid, water based, odorless.
 3. Specific Gravity: 0.996.
 4. Active Content: 7%.
 5. pH: 4-5.
 6. Wt/gal: 8.29 lbs.
 7. Flash Point: > 212 degrees F (> 100 degrees C) ASTM D 3278.
 8. Freeze Point: 32 degrees F (0 degrees C).
 9. VOC Content: Complies with all known national, state and district AIM VOC regulations.
 10. Shelf Life: 1 year in tightly sealed, unopened container.
 11. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
1. Applications: Vertical masonry and cast stone masonry surfaces. Apply water repellent full height of landscape, dumpster and mechanical enclosures.
 2. Number of Coats: Two.
 3. Moisture Absorption When Applied to Masonry: 5 percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Remove loose particles and foreign matter.
- D. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- E. Scrub and rinse surfaces with water and let dry.
- F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply masonry cleaner in accordance with manufacturer's instructions, using procedures and application methods recommended and producing the best results.
- B. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- C. Apply at rate recommended by manufacturer, continuously over entire surface.
- D. Apply two coats, minimum.
- E. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

**SECTION 072100
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at masonry and metal stud cavity wall construction, and **where indicated on the drawings.**
 - 1. Other locations as required to provide complete insulated envelope.
- B. Batt insulation at exterior metal stud cavity walls, and **where indicated on the drawings.**
 - 1. Other locations as required to provide complete insulated envelope.
- C. Sound Batt insulation in cavity of all interior stud walls.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 054000 - Cold-Formed Metal Framing: Board insulation as wall sheathing.
- C. Section 061000 - Rough Carpentry: Supporting construction for batt insulation.
- D. Section 07 2726 - Weather Barriers : Separate air barrier and vapor retarder materials.
- E. Section 07 8401 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- F. Section 092116 - Gypsum Board Assemblies:

1.03 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2025.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.
- H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Inside Exterior Masonry Cavity Walls: Extruded polystyrene board.
- B. Insulation in cavity of Exterior Metal Stud framed walls: Fiberglass Batt insulation with no vapor retarder; Extruded polystyrene as indicated on the drawings.
- C. Insulation in cavity of Interior Metal Stud framed walls. Fiberglass Sound Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, equal to Foamular XPS 250 Type IV, and the following characteristics:
 - 1. R-Value: Provide 1 1/2" thick, **Minimum R-Value: R-5.7**
 - 2. Board Size: 48 x 96 inch (1220 x 2440 mm).
 - 3. Board Size as required to coordinate with specified masonry anchor spacings.
 - 4. Board Edges: Square.
 - 5. Water Absorption, Maximum: 0.1 percent, by volume.
 - 6. Manufacturers: Basis of Design Foamular High R CW 1.55 density (25 PSI compressive strength).
 - 7. Substitutions: See Section 016000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

- A. Fiberglass Batt Insulation: NFPA 101, Class A rated interior finish. Flexible preformed batt, complying with ASTM C 665; E 136, ASTM 665; Type 1, friction fit. Equal to Owens Corning, Pink Next Gen.
 - 1. Flame Spread Index: Less than 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: Less than 50, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - 4. Facing: Unfaced.
 - 5. Provide thickness as required to fill stud for all exterior metal stud wall cavities continuous from floor to underside of roof deck above unless specifically noted otherwise, as required to achieve a fully insulated envelope. **Minimum R-value: R-13 + R-3.8**
 - 6. Manufacturers:
 - a. CertainTeed Corporation; []: www.certainteed.com/#sle.
 - b. Johns Manville; []: www.jm.com/#sle.
 - c. Owens Corning Corp: www.owenscorning.com. Basis of Design.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fiberglass Sound Batt Insulation: NFPA 101, Class A rated interior finish. Flexible preformed batt or blanket, complying with ASTM C 665; E 136, ASTM 665; Type 1, friction fit. Equal to Owens Corning, Pink Next Gen Sound Attenuation Batt (SAB).
 - 1. Flame Spread Index: Less than 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: Less than 50, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - 4. Facing: Unfaced.
 - 5. Provide in thickness as required to fill stud for all interior metal stud walls continuous from floor to structure above unless specifically noted otherwise. Provide insulated envelope for sound isolation. Coordinate with all trades.
 - 6. Provide insulation in all interior wall cavities in thickness of cavity for full height of wall.
 - 7. Manufacturers:
 - a. CertainTeed Corporation; ____: www.certainteed.com/#sle.
 - b. Johns Manville; ____: www.jm.com/#sle.
 - c. Owens Corning Corp: www.owenscorning.com. Basis of Design.
 - 8. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

- A. Wire Ties:
 - 1. Provide wire ties or other acceptable applications as required to hold batt insulation in place where gypsum wall board or other materials are not present at assembly. At underside of roof decking attach by methods required to secure batt insulation in place and comply with applicable UL numbers.
- B. Wire Mesh: Galvanized steel, hexagonal wire mesh, acceptable if meeting all applicable UL design requirements
- C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT CAVITY WALLS

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
 - 2. Full bed 1/8 inch (3 mm) thick.
- B. Install boards to fit snugly between wall ties.
- C. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Coordinate work of this section with construction of air barrier seal specified in Section 07 2726 - Fluid Applied Membrane Air Barriers.
 - 1. Coordinate as required to ensure air barrier is installed continuously on top of sheathing prior to installation of masonry anchors.
- F. Refer to Section 04 2000 Unit Masonry. Coordinate with masonry and veneer anchors.

3.03 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions for all locations specified. .
- B. Install wire ties or other methods as approved to hold insulation batts in place where - refer to 2.04.

3.04 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072616
INTEGRALLY-BONDED UNDERSLAB VAPOR RETARDER

PART 1 — GENERAL

1.01 SUMMARY

- A. The Work of this Section includes, but is not limited to, underslab vapor retarder/barrier membrane that forms an integral bond to poured concrete for use below slabs on grade.
- B. Related sections include, but are not limited to, the following:
 - 1. Section 031000 – Concrete Formwork.
 - 2. Section 033000 – Cast-In-Place Concrete.
 - a. The following specification sections with products by GCP Applied Technologies are the Basis of Design:
 - 1) Section 07 2616 - Integrally Bonded Under Slab Vapor Retarder.
 - 2) Section 07 2726 - Fluid Applied Membrane Air Barriers.
 - 3) Section 07 6526 - Self-Adhering Sheet Flashing.
- C. A single source manufacturer of all sections and associated products is required for approval.
 - 1. Proof of products being equal to the Basis of Design and being compatible with all sections/products shall be submitted to the architect prior to the bid. Approved products must be listed in an addendum.
 - 2. Refer to Specification Section 01 6000 Product Requirements for additional requirements.

1.02 SUBMITTALS

- A. Submit manufacturer's product data, installation instructions and membrane samples for approval.
- B. Manufacturer's Warranty: Ten (10) year Warranty on all Materials: Applicable in state of the project.

1.03 REFERENCE STANDARDS

- A. The following standards and publications are applicable to the extent referenced in the text.
- B. American Society for Testing and Materials (ASTM):
 - 1. D412 Standard Test Methods for Rubber Properties in Tension.
 - 2. D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 3. D3767 Standard Practice for Rubber - Measurements of Dimensions.
 - 4. E96 Standard Test Methods for Water Vapor Transmission of Materials.
 - 5. E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - 6. E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 7. E1745 Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs.
- C. American Concrete Institute (ACI)
 - 1. ACI 302.1R-96 Addendum Vapor Retarder Location: For slabs with vapor-sensitive floor coverings, locate retarder in direct contact with the slab (not beneath a layer of granular fill).

1.04 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of five (5) years of experience in the production and sales of sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five (5) years.
- B. Installer: A firm which has at least three (3) years of experience in work of the type required by this section and as certified by the manufacturer.

- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
1. Pre-Installation Conference: An on-site pre-installation conference with manufacturers technical representative present shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

1.06 WARRANTIES

- A. Sheet Membrane Waterproofing: Provide written ten (10) year material warranty issued by the membrane manufacturer upon completion of the work.
- B. Project Waterproof Warranty: Provide **ten (10) year warranty** signed by Waterproofing Contractor and General Contractor included in specification **Section 01 7833 - Special Project Warranties**.

PART 2 — PRODUCTS

2.01 MATERIALS

- A. Integrally Bonded Vapor Protection: Florprufe® 120 Membrane by GCP Advanced Technologies Construction Products, a 0.5mm (0.021 in) nominal thickness composite sheet membrane comprising 0.4 mm (0.016 in.) of polyolefin film, and layers of specially formulated synthetic adhesive layers. Approved equal manufacturers:
1. Polyguard Underslab TRM
 2. Americover VaporBlock Plus
 3. WR Meadows
- B. The membrane shall form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete. Provide membrane with the following physical properties:

2.02 PHYSICAL PROPERTIES FOR FLORPRUFE® 120 MEMBRANE:

FLORPRUFE 120 IS A CLASS A VAPOR BARRIER AND EXCEEDS THE REQUIREMENTS AS DEFINED BY ASTM E 1745

PROPERTY	TYPICAL VALUE	TEST METHOD
THICKNESS (NOMINAL)	0.5MM (0.021 IN)	ASTM D3767 METHOD A
WATER VAPOR PERMEANCE	0.03 PERMS	ASTM E96 METHOD B *
TENSILE STRENGTH	65 LB./IN	ASTM E154 *
ELONGATION	300%	ASTM D412
PUNCTURE RESISTANCE	3300 GRAMS	ASTM D1709 *
PEEL ADHESION TO CONCRETE	>4 LB./IN	ASTM D903

* ASTM E 1745 REQUIREMENTS.

PART 3 — EXECUTION

3.01 EXECUTION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane applications.
- B. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98, including but not limited to the following:
 - 1. Apply membrane with the HDPE film facing the prepared substrate. Remove the release liner during application.
 - 2. Apply succeeding sheets by overlapping the previous sheet 50-mm (2 in.) along the marked lap line. End Laps should be staggered to avoid a build up of layers.
 - a. Mechanical Fastening Method - To prevent the membrane from moving and gaps opening, the laps should be fastened together at 1.0m (39 in) maximum centers. Fix through the center of the lap area using 12mm (0.5 in) long washer-head self-tapping galvanized screws or similar allowing the head of the screw to bed into the adhesive compound to self-seal. Ensure the membrane lays flat and no openings occur. Additional fastening may be required at corners, details etc.
OR
 - b. Taped Lap Method - For additional security use Preprufe® Tape to secure and seal the overlaps. Overband the lap with the 100mm (4in) wide Preprufe® Tape using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.
 - 3. Mix and apply GCP Advanced Technologies liquid detailing compound to seal around penetrations such as drainage pipes, etc.

END OF SECTION

**SECTION 072726
FLUID-APPLIED MEMBRANE AIR BARRIERS**

PART 1 — GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
1. Materials and installation methods for fluid-applied, vapor permeable air barrier membrane system located in the non-accessible part of the wall.
 2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.
 3. Liquid Flashing: GCP Perma Barrier Universal Flashing and Sealant, one part moisture curing, STPE Sealant and liquid flashing for Terminations and flashing of rough openings.
 4. The following specification sections with products by GCP Applied Technologies are the Basis of Design:
 - a. Section 07 2616 - Integally Bonded Underslab Vapor Retarder
 - b. Section 07 2726 - Fluid Applied Membrane Air Barriers. (includes Liquid Flashing)
 - c. Section 07 6526 - Self-Adhering Sheet Flashing.
 5. A single source manufacturer of all sections and associated products is required for approval.
 6. Proof of products being equal to the Basis of Design and being compatible with all sections/products shall be submitted to the architect prior to the bid. Approved products must be listed in an addendum.
 7. Refer to Specification Section 01 6000 Product Requirements for additional requirements.
- B. Related Sections include the following:
1. Section 03 3000 – Cast-In-Place Concrete.
 2. Section 04 2000 – Unit Masonry.
 3. Section 05 4000 – Gypsum Sheathing.
 4. Section 07 1113 – Bituminous Dampproofing.
 5. Section 07 1325 – Self-Adhering Sheet Waterproofing.
 6. Section 07 5300 – Elastomeric Membrane Roofing.
 7. Section 07 6200 – Sheet Metal Flashing and Trim.
 8. Section 07 9200 – Joint Sealants.

1.03 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the

difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight.
2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2178.
3. It shall have an air permeability not to exceed 0.04 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. @ 75 Pa), when tested in accordance with ASTM E2357.
4. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
5. It shall be durable or maintainable.
6. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - a. Foundation and walls.
 - b. Walls and windows or doors.
 - c. Different wall systems.
 - d. Wall and roof.
 - e. Wall and roof over unconditioned space.
 - f. Walls, floor and roof across construction, control and expansion joints.
 - g. Walls, floors and roof to utility, pipe and duct penetrations.
7. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.05 REFERENCES

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM C1193 Guide for Use of Joint Sealants.
 2. ASTM D412 Standard Test Methods for Rubber Properties in Tension.
 3. ASTM D570 Test Method for Water Absorption of Plastics.
 4. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 5. ASTM D1876 Test Method for Peel Resistance of Adhesives.
 6. ASTM D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting.
 7. ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used. as Steep Roofing Underlayment for Ice Dam Protection.
 8. ASTM D4258 Practice for Surface Cleaning Concrete for Coating.
 9. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 10. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 11. ASTM E96 Test Methods for Water Vapor Transmission of Materials.
 12. ASTM E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 13. ASTM E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
 14. ASTM E2178 Standard Test Method for Air Permeance of Building Materials.
 15. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
 16. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.06 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
 - 2. Include details of mockups.
- C. Samples: Submit representative samples of the following for approval:
 - 1. Fluid-Applied membrane.
 - 2. Self-Adhered Transition Membrane.
 - 3. Self-Adhered Through Wall Flashing.
- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- E. Qualification Data: For Applicator.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- G. Warranty: Submit a sample warranty identifying the terms and conditions stated in Article 1.10, applicable in state of the project.

1.07 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of Five years experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. Source Limitations: Obtain primary air-barrier material and through wall flashing through one source from a single manufacturer. Should project require a vapor permeable and a vapor impermeable air barrier on same project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one source from a single manufacturer.
- C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- D. Mockups: Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
- E. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
- F. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
- G. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals.
 - 2. Review of surface preparation, minimum curing period and installation procedures.
 - 3. Review of special details and flashings.

4. Sequence of construction, responsibilities and schedule for subsequent operations.
5. Review of mock-up requirements.
6. Review of inspection, testing, protection and repair procedures.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect fluid-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTIES

- A. Submit manufacturer's warranty that air barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.
- B. Warranty Period: Ten years from date of completion of the air barrier membrane installation.
- C. Project Waterproof Warranty: Provide **ten (10) year** warranty signed by Waterproofing Contractor and General Contractor.

PART 2 — PRODUCTS

2.01 FLUID-APPLIED, VAPOR PERMEABLE MEMBRANE AIR BARRIER

- A. FLUID-APPLIED AIR BARRIER MEMBRANE: Basis of Design: Perm-A-Barrier® VPL, as manufactured by GCP Applied Technologies, 62 Whittemore Avenue, Cambridge, MA; a fluid-applied, vapor permeable, acrylic membrane that cures to form a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces.
 1. Approved equals:
 - a. Sika Sikagard®-535
 - b. Tremco EXOAIR® 220
 - c. WR Meadows Air Shield LMP
- B. The membrane provides superior protection against the damaging effects of air and liquid water ingress on the building structures. Product shall meet the following requirements:
- C. Membrane Air Permeance: ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.02 L/s. x sq. m. @ 75 Pa).
- D. Assembly Air Permeance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.04 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.2 L/s. x sq. m. of surface area at 75 Pa) when tested in accordance with ASTM E2357.
- E. Water Vapor Permeance: ASTM E96, Method B: Greater than 10 perms.
- F. Pull Adhesion: ASTM D4541: Minimum 20 psi or substrate failure to glass faced wall board, minimum 100 psi to concrete/CMU.
- G. Low temperature flexibility: ASTM D1970: Pass at minus 20 degrees Fahrenheit (at minus 29 degrees Celsius).

- H. Water resistance of in-place membrane: ASTM E331: Pass. No water penetration after 90 minutes @ 299 Pa (6.24 psf) tested over OSB and gypsum sheathing.
- I. Nail sealability: ASTM D1970: Pass UV Exposure Limit: Equal to or greater than 180 calendar days.
- J. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- K. IBC requires exterior walls on Type I-IV construction containing foam plastic insulation to meet NFPA 285 since the 2000 version. IBC 2012 also requires exterior walls that are greater than 40 feet and containing combustible Water Resistive Barrier to meet NFPA 285.
 - 1. Water Vapor Transmission: ASTM E96, Method B: 0.05 perms (2.9 ng/Pa s. sq. m.) maximum
 - 2. Air Permeance at 75 Pa (0.3 in. water) pressure difference: 0.0006 L/s. sq. m (0.00012 cfm/ sq. ft.) maximum
 - 3. Puncture Resistance: ASTM E154: 178 N (40 lbs.) minimum
 - 4. Lap Adhesion at minus 4 degrees Celsius (25 degrees Fahrenheit): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
 - 5. Low Temperature Flexibility: ASTM D1970: Unaffected to minus 43 degrees Celsius (minus 45 degrees Fahrenheit)
 - 6. Tensile Strength: ASTM D412, Die C Modified: minimum 2.7 MPa (400 psi)
 - 7. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: minimum 200%

2.02 PENETRATIONS & TERMINATION SEALANT

- A. **Fluid Applied Liquid Flashing** Membrane for Details and Terminations and Substrate Patching: Equal to **Perma Barrier Universal Flashing and Sealant by GCP Applied Technologies**
 - 1. Approved equals:
 - a. Tremco Dynamic 100
 - b. SikaMembran 540®
 - c. WR Meadows Air Shield LMP
- B. Sealant for Details, Final Terminations and Sheathing Joint Treatment: S100 Sealant manufactured by GCP Applied Technologies: a one-part, neutral curing, ultra low modulus material designed for use with fluid-applied membranes, self-adhered membrane and tapes. 98 g/L maximum VOC content.

PART 3 — EXECUTION

3.01 EXAMINATION

- A. Verify that substrates and conditions are ready to accept the Work of this section. Notify [architect] in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush.
- C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.

3.02 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier assembly.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 50 – 75 mm (2-3 in.) wide, manufacturer's recommended mesh-style wallboard tape. Gaps greater than 6 mm (1/4

- in.) should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the mesh-style wallboard tape and fluid applied air barrier system.
- C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.
 - D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
 - E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
 - F. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
 - G. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
 - H. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
 - I. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
 - J. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
 - K. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.
- B. Prime substrate as required.
- C. Gypsum Sheathing: Fill joints with S100 Sealant per manufacturer's written instructions.

3.04 AIR BARRIER MEMBRANE INSTALLATION

- A. Provide a continuous transition at all roof-to-wall, openings, expansion joints, penetrations, and existing / new construction interface where applicable.
- B. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- C. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
- E. Vapor-Permeable Membrane Air Barrier: 70-mil (1.8-mm) wet film thickness, 40-mil (1.0-mm) dry film thickness.
- F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

- C. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
- D. Continuous structural support of air barrier system has been provided.
- E. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
- F. Site conditions for application temperature and dryness of substrates have been maintained.
- G. Maximum exposure time of materials to UV deterioration has not been exceeded.
- H. Surfaces have been primed, if applicable.
- I. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths.
- J. Termination sealant has been applied on cut edges.
- K. Strips and transition membrane have been firmly adhered to substrate.
- L. Compatible materials have been used.
- M. Transitions at changes in direction and structural support at gaps have been provided.
- N. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
- O. All penetrations have been sealed.
- P. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
- Q. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
- R. Remove and replace deficient air barrier components and retest as specified above.

3.06 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace main air barrier material exposed for more than 180 days.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Remove masking materials after installation.

END OF SECTION

**SECTION 074110
PRE-FORMED METAL WALL PANELS**

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This section covers the pre-finished, pre-fabricated Architectural metal wall panel system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
- B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.02 SUMMARY

- A. Section Includes
 - 1. Factory formed metal wall panels
- B. Related work specified elsewhere
 - 1. Metal Roof Deck: Division 5 - Metal Deck Sections
 - 2. Flashing and Trim: Division 7- Flashing and Sheet Metal
 - 3. Coping and Gravel Stops: Division 7 Roof Specialties and Accessories
 - 4. Sealants: Division 7 Joint Sealers Sections

1.03 DEFINITIONS

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight system.

1.04 QUALITY ASSURANCE

- A. Petersen Aluminum Corp, Acworth, GA, 800-272-4482 Petersen Aluminum Corp, Phoenix, AZ, 833-750-1935 products establish a minimum of quality required.
- B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.
- C. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual.
- D. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.05 SUBSTITUTIONS

- A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution.

1.06 SYSTEM DESCRIPTION

- A. Material to comply with:
 - 1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

1.07 WALL PANEL SYSTEM PERFORMANCE TESTING

- A. General Performance: Metal wall panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
- B. Panels to meet:
 - 1. Metal Wall or Metal Soffit System shall be designed to meet applicable Local Building Code and the Soffit System shall have been tested by the Manufacturer per ASTM E-330 and have the applicable Load Tables published from this Air Bag testing for negative loads.

1.08 WARRANTIES

- A. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finish within specified warranty period.
 - 1. Exposed Panels Finish - deterioration includes 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 a paint to adhere to a bare metal.
 - 2. Warranty Period: **20 Years from the date of substantial completion**
- B. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition

1.09 SUBMITTALS

- A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
- B. Provide finish samples of all colors specified.
- C. Shop drawings: Show fabrication and installation layouts of metal wall panels or metal soffit panels, details of edge conditions, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
- D. Coordination Drawings: Plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved.
- E. LEED Submittals
 - 1. Product data for Credit MR 4.1 and credit MR 4.2: Indicating the percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.
- B. Deliver components, sheets, metal wall panels and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- C. Unload, store and erect metal wall panels in a manner to prevent bending, warping, twisting and surface damage.
- D. Stack metal wall panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness. Do not store metal wall panels in contact with other materials that might cause staining, denting or other surface damage.
- E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.11 PROJECT CONDITIONS

- A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PANEL DESIGN

- A. General: Provide factory-formed metal wall panels designed for wall, soffit and fascia applications as indicated on the drawings. A round interlock leg and concealed fastening system act to improve the flush appearance while providing additional strength.
- B. Wall panels width

1. Flush Wall 12" and 7" widths with 1" height.
- C. Panels to be produced Smooth - Factory Standard.
- D. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.02 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: Petersen Aluminum Corp, Acworth, GA, 800-272-4482 Petersen Aluminum Corp, Phoenix, AZ, 833-750-1935 Flush Wall or Equal.
- B. **Refer to Section 01 2500 Substitution Procedures for substitution requirements.**

2.03 MATERIALS AND FINISHES

- A. Preformed metal panels shall be fabricated of 24 GA and shall be Herr-Voss corrective leveled for flat appearance.
- B. Color: Bone White
- C. Finish shall be Kynar 500 coating with a top side film thickness of 0.70 to 0.90 mil (0.02286 mm) over a 0.25 to 0.3 mil (0.00762 mm) prime coat to provide a total dry film thickness of 0.95 to 1.25 mil (0.03175 mm), to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil (0.00635 mm). Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
- D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
- E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet (365.76 cm). Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
- F. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the wall panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity
- G. Substrate shall be Nailbase
- H. Underlayment
 1. On all surfaces to be covered with metal wall panels, furnish and install a 40 mil (1.016 mm) "Peel & Stick membrane", required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
 - a. W.R Grace "Ice & Water Shield"
 - b. Cetco Strongseal
 - c. Carlisle CCW WIP 300HT
 - d. Interwrap Titanium PSU
 - e. MFM Corp "Wind & Water Shield"
 - f. Polyguard Deck Guard HT or Polyglas HT
 - g. Tamko TW Tile and Metal Underlayment
- I. Sealants
 1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or
 2. One part polysulfide not containing pitch or phenolic extenders or
 3. Exterior grade silicone sealant recommended by roofing manufacturer or

4. One part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.04 FABRICATION

- A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
 1. Max panel length is 55'.
- B. Fabricate components of the system in factory, ready for field assembly.
- C. Fabricate components and assemble units to comply with fire performance requirements specified.
- D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
- B. For the record, 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.

3.02 FASTENERS

- A. Secure units to supports.
- B. Place fasteners as indicated in manufacturer's standards.

3.03 INSTALLATION

- A. Compliance: Comply with manufacturer's product data, recommendations and installation instructions for substrate verification, preparation requirements and installation.
- B. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
- C. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
- D. Provide uniform, neat seams.
- E. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.
- F. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.04 DAMAGED MATERIAL

- A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

3.05 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damage installed products. Clean installed products in accordance with manufacturer's instruction prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

**SECTION 074300
ALUMINUM-FACED COMPOSITE WALL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel system requirements include the following components:
 - 1. Aluminum faced composite panels with mounting system. Panel mounting system including anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete installation.
 - 2. Parapet coping, soffits, sills, border, and filler items indicated as integral components of the panel system or as designed.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Installation of anchors for panel support framing.
- B. Section 05 4000 - Cold-Formed Metal Framing: Panel support framing.
- C. Section 07 2100 - Thermal Insulation
- D. Section 07 2500 - Weather Barriers: Weather barrier behind rainscreen wall system.
- E. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- F. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- G. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- H. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip 2022a.
- I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- K. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.
- L. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates 2022.

- M. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films 2007 (Reapproved 2015).
- N. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- O. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- P. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- Q. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each product to be used, including the following:
 - 1. Storage and handling requirements.
 - 2. Fabrication and installation instructions.
 - 3. Specimen warranty.
- C. Shop Drawings: Indicate layout and elevations, installation sequence, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
- D. Selection Samples: Submit for each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Report: Submit report on full-size mock-up tests for air infiltration, NFPA 285 fire performance, water penetration, and wind performance.
- F. Manufacturer's Field Reports: Submit report within 48 hours of review, and indicate manufacturer representative's observations and any modifications, if any, that are necessary.
- G. Documents showing product compliance with the national and local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.
- H. Maintenance Data: Submit care of finishes and warranty requirements.
- I. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Field Measurements: Verify actual dimensions by field measurement prior to starting fabrication; include recorded field measurements on shop drawings.
- B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Professional Engineer experienced in design of this type of Work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum 5 years of documented experience.
- E. Shop drawings shall show the preferred joint details providing a structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel panel and joints (i.e. Rout and Return Dry and Rear Ventilated System) shall provide a means of

concealed drainage with baffles and weeps for water which may accumulate in members of the system.

- F. Contractor and Aluminum-Faced Composite Wall Panel Sub-contractor shall cooperate with Owner's professional roofing consultant, attend and participate in all roofing consultant related meetings and inspections, and correct all roofing deficiencies reported by the Owner's roofing consultant at no additional cost to the Owner.
- G. Manufacturer's Technical Representative
 - 1. The representative shall have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative shall be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative shall be available to perform field inspections and attend meetings as required herein, and as requested by the Architect.
- H. Manufacturer's Field Inspections
 - 1. Manufacturer's technical representative shall visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Each inspection visit shall include a review of the entire installation to date. After each inspection, a report, signed by the manufacturer's technical representative, shall be submitted to the Owner/Architect noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify architect a minimum of 3 working days prior to site visit by manufacturer's technical representative.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store panels horizontally, off-the-ground, covered with suitable weathertight and ventilated covering in manufacturer's unopened packaging until ready for installation.
- B. Provide markings to identify components in coordination with shop drawings.
- C. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- D. Protect panels from exposure to harmful weather conditions and store in well ventilated space out of direct sunlight.
- E. Store at a slope to ensure positive drainage of any accumulated water.
- F. Do not store in enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
- G. Avoid contact of panels with other materials that might cause staining, denting, or other surface damage.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions, such as temperature, humidity, and ventilation during installation to be within limits as recommended by manufacturer for optimum results.
- B. Do not install wall panel products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

- A. Wall Panel System Installation Warranty: Provide warranty by manufacturer and installer, agreeing to correct defects such as: attachment to panels support system; panel to panel joinery; panel to dissimilar material joinery; and joint seals associated with the panel system, within a five (5) year period after Date of Substantial Completion.
- B. Wall Panel and Extrusions Finish Warranty: Provide manufacturer's finish warranty commencing on Date of Substantial Completion for the following finish :
 - 1. Polyvinylidene Fluoride (PVDF) KYNAR 500 color coated metal finish covering color fading, chalking, and film integrity for 20 year period.

2. Chalking: No more than that represented by a No. 8 rating based on ASTM D4214.
 3. Color Fading: No fading or color change in excess of 8 Hunter color difference units, calculated in accordance with ASTM D2244.
- C. General Contractor's Guarantee: Provide **five (5) year** roofing guarantee signed by General Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Composite Material Wall Panels:
1. Basis of Design: PAC-3000 CS (over all thickness nominal 1.5" including composite panel, extrusions and tracks)
 2. Alucobond Plus material manufactured by 3A Composites USA, 208 West 5th street Benton, KY 4205 or Equal
 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Thermal Movement: Provide system having horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without noise, buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allowing for reasonable ambient temperature and humidity levels at time of fabrication, assembly, and during erection procedures.
- B. Bond Integrity
1. When tested for bond integrity, in accordance with ASTM D 1781, there shall be no adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below the following values:
 - a. Peel Strength: 100 N-mm/mm as manufactured
- C. Wind Performance: Provide system tested in accordance with {rs\#1} and 16 CFR 1201 without permanent deformation or failures of structural members under the following conditions:
1. Design Wind Pressure: In compliance with local building code and authorities having jurisdiction.
- D. Air Leakage: Maximum 0.06 cfm/sq ft (0.003 L/s/sq m) of wall area, when tested at 1.57 psf (0.075 kPa) in accordance with ASTM E283.
- E. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
1. Water penetration defined as uncontrolled water appearing on interior face of wall.
 2. Design to drain leakage and condensation to exterior face of wall.
- F. Fire Performance: Tested in accordance with acceptance criteria of NFPA 285; testing performed for previous project is acceptable provided tested system was truly equivalent.
- G. Building Envelope Performance: Complies with ASHRAE Std 90.1 I-P when tested as part of a building envelope assembly.

2.03 WALL PANEL SYSTEM

- A. Wall Panel System: Panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
1. Provide structural design by or prepared under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
 2. Provide panel jointing and weatherseal using a wet, sealant-sealed system.
 3. Anchor panels to supporting framing without exposed fasteners.
- B. System Characteristics

1. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.
 - a. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.
 - b. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" by AAMA and ANSI/AAMA 302.9 requirements for aluminum windows.
 - c. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70°F (21°C).
 - d. Fabricate panel system so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.
 - e. The finish side of the panel shall have a removable plastic masking applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.
- C. Rout and Return Wet:
 1. System must provide a wet seal (caulked) reveal joint as detailed on drawings. The sealant type shall be as specified in Section 07900 and with foamed type backer rod as indicated on architectural drawings.

2.04 FABRICATION TOLERANCES

- A. Fabricate panels to the following tolerances:
 1. Lengths and Widths: Plus or minus 1/16 inch (1.6 mm), maximum.
 2. Squareness: Diagonal panel measurements equal within 1/8 inch (3.2 mm), maximum.

2.05 COMPONENTS

- A. Composition:
 1. Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.
 2. Overall assembly thickness including composite panels, extrusions, and attachment clips shall be maximum 1-1/2" thick.
- B. Aluminum Face Sheets:
 1. Thickness: 0.5mm (0.0197")
 2. Alloy: AA3000 Series (Painted material)
- C. Panel Weight:
 1. 4mm: 1.5 lb/ft²
- D. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels as required for complete installation.
 1. Provide material strength, dimensions, configuration as required to meet applied loads in compliance with local building code and authorities having jurisdiction requirements.
 2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
 3. Stainless Steel Sheet Components: Comply with ASTM A480/A480M.
- E. Flashing: Sheet aluminum, 0.032 inch (0.8 mm) minimum thickness; finish and color to match MCM sheet.
- F. Anchors, Clips and Accessories: Use one of the following:
 1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.

2. Steel complying with ASTM A36/A36M and hot-dipped galvanized in accordance with ASTM A153/A153M.
 3. Steel complying with ASTM A36/A36M and hot-dipped galvanized in accordance with ASTM A123/A123M, Coating Grade of 10.
- G. Fasteners:
1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
 2. Screws: Self-drilling or self-tapping type 410 alloy stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under fastener heads bearing on exposed surface of metal wall panels.
 3. Bolts: Stainless steel.
 4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.
- H. Extrusions, formed members, sheet, and plate shall conform with ASTM B 209 and the recommendations of the manufacturer.
- I. Provide panel system manufacturer's standard corrosion resistant installation accessories, including fasteners, clips, anchorage devices and attachments.

2.06 FINISHES

- A. Custom Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, conforming to AAMA 2605, and including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as selected from manufacturer's standard line.
1. Finish: Smooth.
- B. Color to be selected by Architect from Manufacturer's full line.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances listed below:
 - a. 1/4 inch (6.3 mm) in any 20 feet (6.1 m) length, vertically or horizontally, or.
 - b. 1/2 inch (12.7 mm) in any single building elevation, whichever is smaller.
 2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required.
 3. For the record, prepare written report, endorsed by panel installer and substrate installer, listing remedies to be used to correct conditions detrimental to installation of panels.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with installation until unsatisfactory conditions have been corrected.
- E. Start of installation constitutes acceptance of substrate conditions.

3.02 INSTALLATION

- A. Installation, General: Applicable to any selected installation method.
1. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

2. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with shop drawings, for fabrication of sheets into system panels.
3. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
4. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
5. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
6. Where joints are designed for field-applied sealant, seal joints completely using only sealants approved by the manufacturer.
7. Install flashings as indicated in system manufacturer's published details, as well as with shop drawings. At continuous horizontal flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
8. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - a. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
 - b. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - c. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - d. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.
- B. Erect panels plumb, level, and true.
- C. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F (-29°C to +82°C). Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.
- D. Panels shall be erected in accordance with an approved set of shop drawings.
- E. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.
- F. Conform to panel fabricator's instructions for installation of concealed fasteners.
- G. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded, and broken members.
- H. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.
- I. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

3.03 FIELD QUALITY CONTROL

- A. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.04 CLEANING

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect installed panel system from damage during construction.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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**SECTION 075423
THERMOPLASTIC-POLYOLEFIN ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered roof system with thermoplastic-polyolefin (TPO) roofing membrane.
- B. Vapor retarder.
- C. Cover boards.
- D. Insulation.

1.02 RELATED REQUIREMENTS

- A. Section 05 1330 - Aluminum Ladders and Aluminum Roof Hatches
- B. Section 061000 - Rough Carpentry
- C. Section 070150.19 - Preparation for Re-Roofing.
- D. Section 076200 - Sheet Metal Flashing and Trim: Counterflashings.
- E. Section 07 7123 - Manufactured Gutters and Downspouts

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- D. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2024.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- F. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.
- G. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).
- H. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).
- I. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2022).
- J. ASTM D1777 - Standard Test Method for Thickness of Textile Materials; 2026.
- K. ASTM D4263 - Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method; 2024.
- L. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.
- M. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).
- N. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2021.
- O. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2026.
- P. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

- Q. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2024.
- R. FM (AG) - FM Approval Guide; Current Edition.
- S. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2026).
- T. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2022).
- U. NRCA (RM) - The NRCA Roofing Manual; 2026.
- V. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
- W. UL (DIR) - Online Certifications Directory; Current Edition.
- X. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Review preparation and installation procedures, in addition to coordination and scheduling required with related work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
 - 1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions provided.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, finish coating installation, special procedures, and perimeter conditions requiring special attention.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Warranty Documentation.
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with required warranty conditions for waterproofing membrane.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least twenty years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years documented experience.
 - 1. Approved by membrane manufacturer.
 - 2. Extend manufacturer's labor and materials warranty.
 - 3. Extend manufacturer's "No Dollar Limit" warranty.
- C. Contractor and Roofing Sub-contactor shall cooperate with Owner's professional roofing consultant, attend and participate in all roofing consultant related meetings and inspections,

and correct all roofing deficiencies reported by the Owner's roofing consultant at no additional cost to the Owner.

1.07 MOCK-UP

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide mock-up for evaluation of surface preparation, installation methods, and workmanship.
- C. Locate mock-up as directed by Architect.
- D. Mock-up may remain as part of this work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight, rain, and other environmental conditions per Manufacturer's requirements.
- D. Provide Safety Data Sheets (SDS) at project site during transportation, storage, and installation of materials.
- E. Comply with requirements from Owner to prevent overloading or disturbance of structure when loading materials onto roof.

1.09 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather, and refer to manufacturer's written installation instructions.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above ____ degrees F (____ degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed that same day.
- E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
- F. Do not allow grease, oils, fats, or other contaminants to come into direct contact with roofing membrane.

1.10 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 20 years after installation. This shall be a **20 year no dollar limit warranty (Edge metal must be included in Manufacturer's 20 year Warranty.)**
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing membrane that leaks or is damaged due to wind or other natural causes.
 - 1. System Warranty Term: 20 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Include accidental punctures in accordance with manufacturer's standard warranty terms.
 - 4. Include hail damage in accordance with manufacturer's standard warranty terms.
 - 5. Include metal roof edge water tightness in accordance with manufacturer's standard warranty terms.
 - 6. Exceptions not permitted, are as follows:
 - a. Damage due to wind speeds greater than 72 mph (115 km/h) and less than 72 mph (115 km/h).

- D. General Contractor's Roofing Guarantee: Provide **five (5) year** roofing guarantee signed by General Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Versico Roofing Systems; Basis of Design: www.versico.com/#sle.
- B. Approved Equal: Carlisle Syntec Systems.
- C. Substitutions: See Section 016000 - Product Requirements.

2.02 ROOFING APPLICATIONS

- A. Thermoplastic-Polyolefin (TPO) Membrane Roofing: Single-ply membrane.
- B. Colors listed are manufactureres colors. Use only when directed in wrtiting by Architect.
 - 1. 80 mil TPO roofing membrane - Light Grey membrane on low slope roofs as directed by Architect
 - 2. 80 mil TPO roofing membrane - Light Grey membrane over existing Gymnasium roof area as directed by the Architect. - refer to the drawings.
 - a. Provide 50 mil ribs @ Gymnasium - refer to drawings. Provide rib spacing @ 19" O.C.

2.03 PERFORMANCE / DESIGN CRITERIA

- A. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value, calculated in accordance with ASTM E1980.
 - 1. Field applied coating may not be used to achieve specified SRI.
- B. Roof Covering External Fire Resistance Classification: Class A when tested in accordance to UL 790.
- C. Wind Uplift:
 - 1. Designed to withstand wind uplift forces calculated in accordance with ASCE 7.
 - 2. Design Wind Speed: In accordance with local building code and authorities having jurisdiction (AHJ).
- D. Drainage: No standing water within 48 hours after precipitation.

2.04 ROOFING MEMBRANE MATERIALS

- A. Single Source Responsibility: Provide and install products from single source.
- B. Base Sheet: Self-adhering, rubberized asphalt membrane laminated to spun-bonded polyester fabric; 40 mil, 0.040 inch (1 mm) thick, minimum.
 - 1. Products:
 - a. Versico Roofing Systems; VapAir Seal 725TR Air/Vapor Barrier: www.versico.com/#sle.
- C. Membrane: Thermoplastic-Polyolefin (TPO); ASTM D6878/D6878M, with internal fabric reinforcing.
 - 1. Thickness: 80 mils, 0.080 inch (2.0 mm), minimum.
 - 2. Sheet Width: Factory fabricated into largest sheets possible.
 - 3. Color: As selected by Architect from manufacturer's full color range.
 - 4. Products:
 - a. Versico Roofing Systems; VersiWeld TPO: www.versico.com/#sle.
- D. Seaming Materials: As recommended by membrane manufacturer.
- E. Flexible Flashing Material: Same material as roofing membrane.

2.05 COVER BOARDS

- A. Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type.
 - 1. Thickness 1/2 inch, minimum.
 - 2. Products:

- a. GP DensDeck Prime Roof Board, distributed by Versico: www.versico.com

2.06 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Complying with ASTM C1289, Type II, Class 2 - Faced with coated glass fiber mat facers on both major surfaces of core foam.
1. Board Thickness at Tapered Insulation: **Refer to Roof Plan.**
 2. Grade and Compressive Strength: Grade 2, with 20 psi (138 kPa), minimum.
 3. Products:
 - a. Versico Roofing Systems; SecurShield Polyiso: www.versico.com/#sle.
- B. Tapered Polyisocyanurate (ISO) Board Insulation for crickets as indicated on drawings and as necessary for application, with minimum slope of 1/2 inch per foot.

2.07 ACCESSORIES

- A. Prefabricated Flashing Accessories:
1. Miscellaneous Flashing: Non-reinforced TPO membrane; 60 mil (0.060 inch) (1.5 mm) thick, in manufacturer's standard lengths and widths.
 2. See Section 076200 for metal counterflashing and trim information.
 3. Corners and Seams:
 - a. Inside Corner: 60 mil, 0.060 inch (1.5 mm) thick, pre-molded TPO, used for flashing inside corners.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Inside Corners: www.versico.com/#sle.
 - b. Outside Corner: 60 mil, 0.060 inch (1.5 mm) thick, pre-molded TPO, used for flashing outside corners.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Outside Corners: www.versico.com/#sle.
 - c. T-Joint Covers: 60 mil, 0.060 inch (1.5 mm) thick, 4-1/2 inch (114 mm) in diameter, pre-punched TPO T-joint covers, used to seal step-offs at splice intersections.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO T-Joint Covers: www.versico.com/#sle.
 - d. Curb Wrap Corners: 60 mil, 0.060 inch (1.5 mm) thick TPO membrane, with 12 inch (305 mm) overall height and 6 inch (152 mm) wide base flange.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Curb Wrap Corners: www.versico.com/#sle.
 - e. Inside/Outside Corner: 60 mil, 0.060 inch (1.5 mm) thick, pre-molded TPO, used for flashing inside or outside corners.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Universal Corners: www.versico.com/#sle.
 4. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
 - a. Pipe Seals: Injection molded, pre-formed TPO flashings for pipes from 3/4 inch to 8 inch (19 mm to 203 mm) in diameter.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Pipe Seals: www.versico.com/#sle.
 - b. Pipe Seals: Prefabricated 60 mil, 0.060 inch (1.5 mm) thick reinforced TPO flashings for pipes from 1 inch to 6 inch (25.4 mm to 152 mm) in diameter.
 - 1) Products:

- (a) Versico Roofing Systems; VersiWeld TPO Split Pipe Seals:
www.versico.com/#sle.
 - c. Pipe Seals, Square: Prefabricated 60 mil, 0.060 inch (1.5 mm) thick reinforced TPO flashings for pipes 3 inch (76 mm) square.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Square Tubing Wraps:
www.versico.com/#sle.
- 5. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
 - a. Molded Sealant Pockets: Interlocking, two-piece, injection molded TPO weldable pockets adjustable from 11-1/2 inch to 7-1/2 inch (279 mm to 191 mm) long, and used to waterproof pipe clusters or other odd shaped penetrations.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld Molded Sealant Pockets:
www.versico.com/#sle.
 - b. Prefabricated Sealant Pockets: Two-piece, prefabricated design using reinforced TPO detail membrane and coated metal to form rigid oversized sealant pocket.
 - 1) Products:
 - (a) Versico Roofing Systems; Custom Prefabricated Sealant Pockets:
www.versico.com/#sle.
 - c. Pockets Extensions: 60 mil, 0.060 inch (1.5 mm) thick TPO reinforced membrane and TPO coated metal used with prefabricated or molded sealant pockets for extra long applications.
 - 1) Products:
 - (a) Versico Roofing Systems; VersiWeld TPO Pocket Extensions:
www.versico.com/#sle.
- 6. Pressure Sensitive Cover Strips: 6 inch (152 mm) wide, with 30 mils, 0.030 inch (0.76 mm) thick non-reinforced TPO membrane laminated to 30 mils, 0.030 inch (0.76 mm) thick fully cured synthetic rubber pressure-sensitive adhesive.
 - a. Products:
 - 1) Versico Roofing Systems; VersiWeld TPO Pressure-Sensitive Coverstrip:
www.versico.com/#sle.
- 7. Reinforced Universal Securement Strip (RUSS): 45 mils, 0.045 inch (1.1 mm) thick, reinforced TPO membrane strip with 35 mils, 0.035 inch (0.89 mm) thick cured TPO splice tape adhesive strips, 3 inch (76 mm) wide, and laminated to TPO membrane.
 - a. TPO Membrane Width: 6 inch (152 mm), nominal.
 - b. Splice tape adhesive strips are laminated to one edge.
 - c. Products:
 - 1) Versico Roofing Systems; VersiWeld TPO Pressure-Sensitive RUSS:
www.versico.com/#sle.
- B. Walkway Rolls: Heat weldable TPO membrane, 34 inch (864 mm) wide by 50 feet (15.2 m) long, with 170 mils, 0.170 inch (4.3 mm) overall thickness, gray colored; used to protect TPO membrane in areas exposed to foot traffic.
 - 1. Products:
 - a. Versico Roofing Systems; TPO Heat Weldable Walkway Rolls:
www.versico.com/#sle.
- C. Cover Board Adhesive: Two component polyurethane, expanding foam.
 - 1. Versico Roofing System; Flexible DASH Dual Cartridge.
- D. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, and compatible with roofing materials; 6 inch (152 mm) wide; self adhering.
- E. Fasteners: Appropriate for application indicated as recommended and approved by membrane manufacturer.

1. Length as required for thickness of membrane and insulation material and penetration of deck substrate; with metal washers.
2. Fasteners, Wood/Steel Drill-in: Corrosion-resistant #15 threaded drill-in fastener with #3 Phillips drive for attachment through fastening plate into steel with 22 gauge, 0.0299 inch (0.76 mm) or greater thickness, and wood plank or CDX plywood roof decks with 15/32 inch (12 mm) or greater thickness.
 - a. Products:
 - 1) Versico Roofing Systems; HPV Fasteners: www.versico.com/#sle.
3. Fasteners, Steel Purlins: Hex-head drive, self-drilling point, and corrosion-resistant.
 - a. Products:
 - 1) Versico Roofing Systems; Purlin Fastener: www.versico.com/#sle.
4. Fasteners and Plates: Barbed metal plate with 2-3/8 inch (60 mm) diameter, #21 threaded fastener with deep buttress threads at 13 per inch (13 per 25.4 mm), and corrosion-resistant.
 - a. Products:
 - 1) Versico Roofing Systems; HPV-XL Fasteners and Plates: www.versico.com/#sle.
5. Fastener and Plate Assembly: Phillips head screw pre-assembled with 3 inch (76 mm) diameter metal or plastic locking insulation plate, for use with wood or metal roof decks.
 - a. Products:
 - 1) Versico Roofing Systems; ASAP Insultite Fasteners: www.versico.com/#sle.
6. Fasteners, Concrete Hammer-in: Non-threaded, corrosion-resistant hammer-in fastener, for use with structural concrete roof decks.
 - a. Products:
 - 1) Versico Roofing Systems; CD-10 Fasteners: www.versico.com/#sle.
7. Fasteners, Concrete Drill-in: Corrosion-resistant #14 threaded drill-in fastener with #3 Phillips drive, for use with structural concrete roof decks.
 - a. Products:
 - 1) Versico Roofing Systems; MP 14-10 Fasteners: www.versico.com/#sle.
8. Expansion Anchor, Nail-In: 1/4 inch (6.4 mm) diameter by 1-1/4 inch (32 mm) long stainless steel expansion anchor with zinc alloy plated nail having round mushroom shaped head; used for termination bar or seam fastening plate attachment.
 - a. Products:
 - 1) Versico Roofing Systems; Zinc Nail-In Anchors: www.versico.com/#sle.
9. Base Sheet Fasteners and Plates: Manufacturer's pre-assembled, 1.8 inch (46 mm) long, galvanized steel tube and 2.7 inch (69 mm) diameter galvalume plate with high tensile steel wire locking staple.
 - a. FM (AG) listed and labeled.
 - b. Products:
 - 1) Versico Roofing Systems; Dual Prong Base Sheet Fasteners: www.versico.com/#sle.
10. Metal, Seam Fastening Plates: Galvalume coated metal plate, 22 gauge, 0.0366 inch (0.853 mm) minimum thickness, with 2 inch (51 mm) nominal diameter, used for insulation attachment on mechanically fastened systems or membrane securement at angle changes on adhered systems with appropriate fastener.
 - a. Products:
 - 1) Versico Roofing Systems; 2 Inch Seam Fastening Plates: www.versico.com/#sle.
11. Metal, Insulation Fastening Plates: Hexagon shaped galvalume-coated steel plate, with 2-7/8 inch (73 mm) hexagon width.
 - a. Products:
 - 1) Versico Roofing Systems; SecurFast Insulation Fastening Plate: www.versico.com/#sle.

12. Metal Insulation Fastening Plates: Square galvalume-coated steel plate, 3 inch (76 mm) square width with flat or recessed bottom.
 - a. Products:
 - 1) Versico Roofing Systems; Accutrac Plate: www.versico.com/#sle.
13. Plastic Fasteners and Metal Plates: Glass-filled nylon auger fastener with 1 inch (25.4 mm) diameter head, and stamped galvalume-coated steel plate with 3 inch (76 mm) diameter, 26 gauge, 0.0217 inch (0.551 mm) thick for insulation attachment, or 2 inch (51 mm) diameter, 22 gauge, 0.0366 inch (0.853 mm) thick for membrane attachment.
 - a. Products:
 - 1) Versico Roofing Systems; Polymer Gyptec Fasteners and Plates: www.versico.com/#sle.
14. Metal Fastener: Corrosive-resistant deck screws with 3/8 inch (9.5 mm) thread diameter and 6-Lobe (T40) drive head used with 3 inch (76 mm) diameter metal plate for attaching insulation to cementitious wood fiber and gypsum decks in mechanically fastened membrane systems; provide 2 inch (51 mm), minimum, deck penetration.
 - a. Products:
 - 1) Versico Roofing Systems; Lite-Deck Fasteners: www.versico.com/#sle.
15. Plastic Plate: Barbed polymer fastening plate, with 2-3/8 inch (60 mm) diameter, and used with appropriate fasteners for membrane and pressure-sensitive securement for mechanically fastened roofing systems over metal roof decks.
 - a. Products:
 - 1) Versico Roofing Systems; HPV-XL Polymer Seam Plates: www.versico.com/#sle.
16. Plastic Fastening Strip: Engineered polymer strip, 1 inch (25 mm) wide, with factory punched holes 3 inch (76 mm) on center; 250 feet (76.2 m) long coil.
 - a. Products:
 - 1) Versico Roofing Systems; Polymer Fastening Strip: www.versico.com/#sle.
17. Metal Fastening Bar: Galvalume-coated steel bar, 1 inch (25 mm) wide, with factory punched holes 6 inches (152 mm) on center; 10 feet (3 m) long.
 - a. Products:
 - 1) Versico Roofing Systems; Metal Fastening Bar: www.versico.com/#sle.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
 1. Bonding Adhesive/Primer: Low-VOC, TPO and EPDM membrane bonding adhesive, rubber/solvent blend base, and light green colored.
 - a. Products:
 - 1) Versico Roofing Systems; CAV-GRIP 3V Low-VOC Adhesive/Primer: www.versico.com/#sle.
- G. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- H. Strip Reglet Devices: Consisting of galvanized steel, with maximum possible length for each location and attachment flanges.
- I. Sealants: As recommended by membrane manufacturer.
 1. Lap Sealant: Butyl-based contact cement, white colored.
 2. Water Cut-Off Mastic Sealant: One-component, low-viscosity, self-wetting, butyl-blend mastic sealant used between membranes terminated with compression-based seal.
 - a. Products:
 - 1) Versico Roofing Systems; G-500 CM Water Cut-Off Mastic: www.versico.com/#sle.
 3. Sealant: One-component, 100 percent solids, solvent-free, polyether sealant used to provide weather-tight seal.
 - a. Products:
 - 1) Versico Roofing Systems; Universal Single-Ply Sealant: www.versico.com/#sle.
 4. Pourable Sealant: Two-component, solvent-free, polyurethane-based sealant, black colored.

- a. Products:
 - 1) Versico Roofing Systems; G400PS-2 Pourable Sealant: www.versico.com/#sle.
- 5. Pourable Sealant: One-component, moisture curing, elastomeric polyether sealant, black colored.
 - a. Products:
 - 1) Versico Roofing Systems; One-Part Pourable Sealant: www.versico.com/#sle.
- 6. Pourable Sealant: One-component, moisture curing, elastomeric polyether sealant, white colored.
 - a. Products:
 - 1) Versico Roofing Systems; White One-Part Pourable Sealant: www.versico.com/#sle.
- J. Membrane Cleaner: Manufacturer's standard, clear, and solvent-based membrane cleaner.
 - 1. Applications: Used for cleaning in-service and new EPDM black or white membrane and TPO membrane in preparation for application of primer, adhesives, seam tape, and flashing.
 - a. Products:
 - 1) Versico Roofing Systems; Weathered Membrane Cleaner: www.versico.com/#sle.
- K. Primer: Manufacturer's recommended product.
 - 1. Primer: Solvent-based and used for one-step priming of EPDM or TPO membrane surfaces.
 - a. Products:
 - 1) Versico Roofing Systems; Low-VOC EPDM and TPO Primer: www.versico.com/#sle.
 - 2. Primer: Low-VOC, aerosol contact adhesive/primer with rubber/solvent base used for membrane surfaces.
 - a. Products:
 - 1) Versico Roofing Systems; Cav-Grip 3V Low-VOC Adhesive/Primer: www.versico.com/#sle.
- L. Roof Edgings and Terminations: Manufacturer's standard roof edge and termination accessories.
 - 1. Steel Cover: Galvanized steel, 24 gauge, 0.0239 inch (0.61 mm) thick, with finish as selected by Architect.
 - 2. Color: As selected by Architect.
 - 3. Drip Edge: Two-part assembly that includes an L-shaped continuous cleat with pre-slotted fastening holes and a decorative cover with pre-slotted fastening holes on the roof flange.
 - a. Material: 24-gauge Kynar 500-coated galvanized steel.
 - b. Testing: Tested in accordance with ANSI/SPRI FM-4435 ES-1 Standard for sustained Wind Speeds per the International Building Code.
 - c. Products: Equal to VersiTrim 200 Drip Edge
 - 4. Roof Gravel Stop: Two-part assembly that includes an L-shaped continuous cleat with pre-slotted fastening holes and a decorative cover with pre-slotted fastening holes on the roof flange.
 - a. Cover Height: As detailed on drawings, and top edge extending 1 inch above roof surface.
 - b. Material: 24-gauge Kynar 500-coated galvanized steel.
 - c. Testing: Tested in accordance with ANSI/SPRI FM-4435 ES-1 Standard for sustained Wind Speeds per the International Building Code.
 - d. Products: Equal to Versitrim 200 Gravel Stop

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that surfaces and site conditions are ready to receive work.

- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips, nailing strips, and reglets are in place.

3.02 SURFACE PREPARATION

- A. Clean substrate thoroughly prior to roof application.
- B. Do not begin this work until other work that requires foot or equipment traffic on roof has been completed.
- C. Apply manufacturer's recommended vapor retarder or temporary roofing before roof installation.
- D. See Section 070150.19 for additional re-roofing preparation information.

3.03 INSTALLATION - GENERAL

- A. Install roofing system in accordance with manufacturer's instructions, as well as NRCA (RM) and NRCA (WM) applicable requirements.
- B. Application of roofing membrane during unsuitable weather is not permitted.
- C. Application of roofing membrane when ambient temperature is outside temperature range recommended by manufacturer is not permitted.
- D. Application of roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring is not permitted.
- E. Exposing materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day is not permitted.
- F. Coordinate this work with installation of associated counterflashings being installed as specified in other sections as this work proceeds.
- G. When substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions, and do not proceed until corrections have been made.

3.04 VAPOR RETARDER APPLICATION

- A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of air barrier plane.
- B. Verify that vapor retarder is clean and dry, continuous, and ready for application of insulation.

3.05 INSULATION APPLICATION

- A. Attachment of Insulation at Roof Decking:
 - 1. Low Sloped Roofs
 - a. Mechanically fasten both layers of insulation to deck in accordance with roofing manufacturer's instructions and FM (AG), FM DS 1-28, and FM DS 1-29 applicable requirements.
 - 2. Gymnasium Roof
 - a. **Carefully mechanically fasten** both layers of insulation to existing Gymnasium Tectum roof deck in accordance with roofing manufacturer's instructions and FM (AG), FM DS 1-28, and FM DS 1-29 applicable requirements, **using Light Gauge Fasteners.**
- B. Installing wet, damaged, or warped insulation boards is not permitted.
- C. Apply subsequent layers of insulation with joints staggered minimum 6 inch (152 mm) from joints of preceding layer.

- D. Apply tapered insulation to required slope pattern in accordance with manufacturer's instructions.
- E. Apply boards with edges in moderate contact without forcing, and with gap between boards no greater than 1/4 inch (6 mm) wide; cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Tape joints of insulation in accordance with roofing and insulation manufacturer's instructions.
- G. Only apply quantity of insulation than can be completely waterproofed in same day.

3.06 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears; place sheet membrane into place without stretching.
- B. Shingle joints on sloped substrates in direction of drainage.
- C. At membrane intersections with vertical surfaces, provide the following:
 - 1. Extend membrane over and up cant strips at least 4 inch (102 mm) onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- D. Coordinate installation of roof related flashings, sumps, and drains; locate field splices away from low areas and roof drains, and shingle lap upslope sheets over downslope sheets.
- E. Daily Seal: Provide daily seal in accordance with manufacturer's installation instructions at end of each work day to prevent infiltration of water at incomplete flashings, terminations, and other unfinished membrane edges.

3.07 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Roofing/Wall Consulting Services:
 - 1. Contractor and Roofing Sub-contractor shall cooperate with Owner's professional roofing consultant, attend and participate in all related roofing consultant meetings and inspections, and correct all roofing deficiencies reported by the Owner's roofing consultant at no additional cost to the Owner.
- C. Attendance is required on-site of roofing and insulation material manufacturer's as required by manufacturer to obtain all specified warranties during installation of this work.

3.08 CLEANING

- A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove wrappings, empty containers, paper, and other debris from roof daily, and dispose of debris in compliance with local, State, and Federal regulations.
- C. Remove bituminous markings from finished surfaces.
- D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- E. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

**SECTION 076200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including other applications indicated on the drawings.
- B. **High temperature self-adhered roofing underlayment;**

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 5423 - **Thermoplastic-Polyolefin Roofing - TPO**
- C. Section 079005 - Joint Sealers.
- D. Section 07 7124 - Manufactured Gutters and Downspouts

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.
- B. ASTM B32 - Standard Specification for Solder Metal; 2020.
- C. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2024).
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.
- G. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene two weeks before starting work of this section.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 6 inch (by 6 mm) in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with _____ years of documented experience.

1.07 MOCK UP

- A. Refer to 01 4000 Quality Requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.09 PRE-ROOFING MEETING:

- A. Organize and conduct a meeting at the construction site 2 weeks before scheduled start of roof system installation with roofing installer; installer of each component of related work, including deck or substrate construction, roof equipment, penetrations of roof deck, and other work integral with or adjacent to roofing; the architect; the Owner; the Division of Construction Management inspector, roofing manufacturer's representative; approved roofing consultant; owner's construction manager; and other parties involved with roofing system performance, including owner's insurance representative, independent testing agencies, and governing authorities.
 - 1. Walk roof areas to review and discuss substrate preparation including repair of unacceptable surfaces, roof drainage, penetrations, equipment curbs, and work performed by other trades which requires coordination with roofing system.
 - 2. Examine steel deck for proper flatness and slope, review structural capability for supporting roofing system and methods of fastening.
 - 3. Review contract document requirements and submittals for roofing system, including roofing schedule, inspection and testing, and environmental conditions. Identify what are considered unacceptable weather conditions for roofing, and which governing regulations or insurance requirements will affect roofing system installation.
 - 4. Document discussions in writing, including actions required, and distribute copy of reports to each meeting participant.

1.10 WARRANTIES:

- A. Manufacturer's finish warranty:
 - 1. Covering bare metal against rupture, structural failure and perforation due to normal atmospheric corrosion exposure.
 - 2. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading.
 - 3. Duration: twenty (20) years.
- B. General Contractor's Guarantee: Provide **five (5)** year roofing guarantee signed by General Contractor.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge thick base metal, shop pre-coated with Kynar coating. PVDF.
 - 1. Pre-finished Kynar 24 Gauge AAMA 2605; multiple coat, thermally cured fluoropolymer finish system. Provide manufacturer's standard prime coat on underside. Submit certification that this finish is being provided. **Provide ES-1 sheet metal thickness as required.**
 - 2. **Provide 22 Gauge flashing in locations noted in drawings.**
 - 3. Color: As selected in writing by Architect & Owner from manufacturer's full colors.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Primer: As recommended by manufacturer for application and specified finish.
- C. Protective Backing Paint: Asphaltic mastic, ASTM D 4479 Type I.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: {rs#1}; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Sealant: Type II specified in Section 079005.
- G. Plastic Cement: {rs#1}, Type I.

- H. Provide manufacturers' accepted bond breaker where dissimilar metals come in contact with on another.
- I. **Refer to section 07 6526 Self-adhering Sheet Flashing for metal drip through wall stainless steel flashing, termination bar, and flexible flashing.**
- J. **High Temperature Self-Adhered Roofing Underlayment:**
 - 1. **Basis of Design: GCP Grace Ultra**
 - a. **Thickness: 30 mils thi**
 - b. **Description: Butyl roofing underlayment backed by high density crosslaminated polyethelene film.**
 - c. **Provide at transition between TPO and PEMB Wall Panel and in any other locations indicated on drawings.**
 - d. **Install per manufacturer's recommendations.**

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 1 inches (____ mm) wide, interlocking with sheet. Provide continuous cleats where indicated on drawings and/or recommended by SMACNA.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- C. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

**SECTION 076526
SELF-ADHERING SHEET FLASHING**

PART 1 — GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 042000 – Unit Masonry.

1.02 SUMMARY

- A. Section provides for a flexible rubberized asphalt, self-sealing through-wall flashing and wall flashing accessories. Referred to on drawings as flexible wall flashing, flexible flashing, and through-wall flashing.
- B. The following specification sections with products by GCP Applied Technologies are the Basis of Design:
 - 1. Section 07 2616 - Integrally Bonded Under Slab Vapor Retarder.
 - 2. Section 07 2726 - Fluid Applied Membrane Air Barriers, Vapor Permeable.
 - 3. Section 07 6526 - Self-Adhering Sheet Flashing.
- C. A single source manufacturer of all sections and associated products is required for approval.
 - 1. Proof of products being equal to the Basis of Design and being compatible with all sections/products shall be submitted to the architect prior to the bid. Approved products must be listed in an addendum.
 - 2. Refer to Specification Section 016000 Product Requirements for additional requirements.

1.03 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM E96 – Test Methods for Water Vapor Transmission of Materials.
 - 2. ASTM D570 – Test Method for Water Absorption of Plastics.
 - 3. ASTM E154 – Test Method for Water Vapor Retarders used in contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
 - 4. ASTM D1004 – Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 5. ASTM D1938 – Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
 - 6. ASTM D1876 – Test Method for Peel Resistance of Adhesives.
 - 7. ASTM D1970 – Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 8. D412 – Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.

1.04 SUBMITTALS

- A. Product Data and Shop Drawings: Submit for each product; Spec-Data®/Data Sheets, details and installation procedures.
- B. Test Reports: Indicating compliance with the performance requirements of this section.
- C. Samples of flashing.
- D. Manufacturer's Warranty: Applicable in the state of the project.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's recommendations for storage and handling of each product.

1.06 WARRANTY

- A. Standard Product Warranty:

1. Submit manufacturer's warranty that flashing and accessories are free of defects at time of delivery, and are manufactured to meet manufacturer's published physical properties and material specifications.
 2. Warranty Period: Ten (10) years from date of completion of the substantial completion.
 3. Installer to warrant that flashing and accessories have been installed in accordance with manufacturer's recommendations.
- B. Project Waterproof Warranty: Provide **ten (10) year** warranty signed by Waterproofing Contractor and General Contractor.

1.07 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of five (5) years of experience in the production and sales of sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five (5) years.
- B. Installer: A firm which has at least three (3) years of experience in work of the type required by this section and as certified by the manufacturer.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: An on-site pre-installation conference with manufacturers technical representative present shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

PART 2 — PRODUCTS

2.01 MATERIALS

- A. **Flashing Description: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mils) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.**
- B. Performance Requirements:
1. Water Vapor Transmission: ASTM E96, Method B – 2.9 ng/m²sPa (0.05 perms) maximum
 2. Water Absorption: ASTM D570 – Max. 0.1% by weight
 3. Puncture Resistance: ASTM E154 – 356 N (80 lbs)
 4. Tear Resistance:
 - a. Initiation – ASTM D1004 – min. 58 N (13.0 lbs) M.D.
 - b. Propagation – ASTM D1938 – min. 40 N (9.0 lbs) M.D.
 5. Lap Adhesion at -4°C (25°F): ASTM D1876 – 880 N/M (5.0 lbs/in.) of width
 6. Low Temperature Flexibility – ASTM D1970 – Unaffected to -43°C (-45°F)
 7. Tensile Strength: ASTM D412, Die C Modified – Min. 5.5 MPa (800 psi)
 8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C – Min. 200%
- C. Product: Perm-A-Barrier® Wall Flashing manufactured by GCP Advanced Technologies Construction Products.
- D. Wall Flashing Accessories:
1. Primer:
 - a. Description: Water-based primer which imparts an aggressive, high tack finish on the treated substrate.
 - 1) Flash Point: No flash to boiling point
 - 2) Solvent Type: Water
 - 3) VOC Content: Not to exceed 10 g/L

- 4) Application Temperature: -4°C (25°F) and above
 - 5) Freezing point (as packaged): -7°C (21°F)
- b. Product: Perm-A-Barrier WB Primer manufactured by GCP Advanced Technologies Construction Products.
2. Termination Mastic:
 - a. Description: Rubberized asphalt-based mastic with 200 g/L max. VOC Content.
 - b. Product: Bituthene® Mastic manufactured by GCP Advanced Technologies Construction Products.
3. Optional Primer:
 - a. Description: Water-based primer which imparts an aggressive, high tack finish on the treated substrate. 1 g/l max. VOC content.
 - b. Product: Perm-A-Barrier Primer Plus by GCP Advanced Technologies Construction Products.
 - c. Description: High tack low VOC solvent based primer. 200 g/l max. VOC content.
 - d. Product: Bituthene Primer B2 LVC manufactured by GCP Advanced Technologies Construction Products.
4. Joint Sealant: Per manufacturer's recommendations.
5. Weep Vents and Mortar Nets: Refer to Section 04 2000 - Unit Masonry for materials and additional installation requirements.
6. Termination Bar
 - a. Single Lip 26 gauge x 1-1/4 inches, Type 304 Stainless Steel Stainless Steel termination bar with 1/2" lip at 45° and pre-drilled holes spaced at 16" inches on center for attachment. Refer to drawings for additional information.
7. Drip Edge: Provide stainless steel drip edge at all locations where wall flashing terminates at the exterior face of brick, cast stone veneers and at locations shown on drawings.
 - a. 26 gauge, Type 304 Stainless Steel
 - b. Size and configuration as detailed on drawings.
 - c. Install in accordance with manufacturer's written instructions and as detailed on drawings. Flashing shall not be exposed to ultraviolet light when properly installed.
 - d. Include drip edge in project mock up. Also, mock up drip edge conditions at outside and inside corners for approval prior to proceeding.
8. Perm-A-Barrier Liquid Flashing (GCP or approved equal): Fluid applied flashing membrane and detailing accessory.
 - a. Provide all system components.
 - b. Provide as shown on drawings to manufacturer's specifications.
 - c. Provide at all exterior openings and penetrations, including but not limited to, head, jambs and sill of all exterior doors, louvers and storefronts.

PART 3 — EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of flashing. Remove all deleterious materials from surfaces to be flashed and as shown on drawings.

3.02 INSTALLATION

- A. General: Install flashing to dry surfaces at air and surface temperatures of -4°C (25°F) and above in accordance with manufacturer's recommendations at locations indicated on Construction Documents.
- B. Flexible Wall Flashing:
 1. Precut pieces of flashing to easily handled lengths for each location.
 2. Remove silicone-coated release paper and position flashing carefully before placing it against the surface.
 3. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.

4. Overlap adjacent pieces 50 mm (2 in.) and roll all seams with a steel hand roller.
 5. Trim bottom edge 13 mm (1/2 in.) back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.
 6. At heads, sills and all flashing terminations turn up ends a minimum of 50 mm (2 in.) and make careful folds to form an end dam, with the seams sealed.
 7. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
 8. Do not expose flashing membrane to sunlight for more than thirty days prior to enclosure.
 9. Install Perma-A-Barrier Liquid Flashing per manufacturer's instructions at all head, jamb, and sill of exterior wall penetrations and as shown on the drawings.
- C. Accessories:
1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture, apply Perm-A-Barrier Primer Plus by air spray, brush or roller or apply Perm-A-Barrier WB Primer by brush or roller at the rate recommended by manufacturer, prior to flashing installation. Allow the primer to dry completely before flashing application.
 2. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts, and penetrations.
 3. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to flashing installation. Allow primer to dry completely before flashing application.

END OF SECTION

**SECTION 077124
MANUFACTURED GUTTERS AND DOWNSPOUTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished galvanized steel gutters and downspouts.

1.02 RELATED REQUIREMENTS

- A. Section 07 5423 - Thermoplastic Polyolefin Roofing
- B. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- G. ASTM B32 - Standard Specification for Solder Metal 2020.
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- J. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction 2012 (Reapproved 2019).
- K. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- L. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007 (Reapproved 2018).
- M. CDA A4050 - Copper in Architecture - Handbook current edition.
- N. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Comply with International Plumbing Code code for size and method of rain water discharge.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- D. Samples: Submit one sample of gutter, with downspout attached, 12 inches long each, illustrating component design, finish, color, and configuration.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gutters and Downspouts:
 - 1. ATAS International, Inc; Water Control System: www.atas.com/#sle.
 - 2. Cheney Flashing Company; []: www.cheneyflashing.com/#sle.
 - 3. Drexel Metals Inc: www.drexmet.com/#sle.
 - 4. OMG Roofing Products; []: www.omgroofing.com/#sle.
 - 5. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc; []: www.saf.com/persys/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Scupper and Collectors:
 - 1. ATAS International, Inc; Scuppers and Collector Boxes: www.atas.com/#sle.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
 - 1. Finish: Shop pre-coated with PVDF (polyvinylidene fluoride) coating.
 - 2. Color: Custom Color to match Architect's sample.
 - 3. Primer: Zinc molybdate type.
 - 4. Protective Backing Paint: Zinc molybdate alkyd.
 - 5. Solder: ASTM B32; Sn50 (50/50) type.
 - 6. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.

2.03 COMPONENTS

- A. Gutters: SMACNA square style profile. Contractor to size as required by local rain charts.
- B. Downspouts: SMACNA Rectangular profile. Contractor to size as required by local rain charts. Coordinate with cast Iron downspout boots.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.
- D. Fasteners: Galvanized steel , with soft neoprene washers.
- E.

2.04 ACCESSORIES

- A. Splash Pads - at Gymnasium locations as indicated on the drawings.
 - 1. Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

2.05 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.06 FINISHES

- A. Fluoropolymer Coating: PVDF High Performance Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.07 WARRANTIES

- A. General Contractor's Roofing Guarantee: Provide **five (5) year** roofing guarantee signed by General Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters 1/8 inch per foot .

END OF SECTION

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**SECTION 078401
FIRESTOPPING
FIRESTOPPING**

PART 1 – GENERAL

THIS SPECIFICATION IS WRITTEN USING HILTI AS A SPECIFICATION AND DESIGN BASIS. IT IS NOT INTENDED TO LIMIT MANUFACTURERS. THE FOLLOWING MANUFACTURERS: 3M, TREMCO AND S.T.I. ARE APPROVED FOR BIDDING PURPOSES, HOWEVER CONTRACTOR MUST SUBMIT FOR APPROVAL SYSTEMS AND PRODUCTS THAT ARE EQUAL TO THE SPECIFIED HILTI PRODUCTS. THESE SUBMITTALS MUST BE APPROVED BY THE GENERAL CONTRACTOR'S FIRESTOPPING CONSULTANT, THE GENERAL CONTRACTOR AND THE ARCHITECT PRIOR TO INCORPORATION INTO THE PROJECT.

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in/ joints between fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Safing slot gaps between edge of floor slabs and curtain walls.
- C. Openings between structurally separate sections of wall or floors.
- D. Gaps between the top of walls and ceilings or roof assemblies.
- E. Expansion joints in walls and floors.
- F. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- G. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Section 03 3000 - Cast-In-Place Concrete
 - 2. Section 07 9005 - Joint Sealants
 - 3. Section 09 2116 - Gypsum Board Assemblies
 - 4. Division 22 - Plumbing
 - 5. Division 23 - HVAC
 - 6. Division 26 - Electrical

1.05 REFERENCES

- A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements:UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Test Requirements:UL 2079, "Tests for Fire Resistance of Building Joint Systems"
- D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - 1) Forming Materials (XHKU)
 - 2) Joint Systems (XHBN)
 - 3) Perimeter Fire Containment Systems (XHDG)
2. Alternate Systems: "Omega Point Laboratories Directory" (updated annually).
3. Test Requirements: ASTM E 1966-01, "Standard test method for Fire Resistive Joint Systems"
4. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus".
5. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
6. ASTM E-84, "Standard Test Method for Surface Burning Characteristics of Building Materials".
7. ASTM G 21, "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi".
8. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
9. All applicable building codes: But not limited to the following: IBC.
10. NFPA 101 - Life Safety Code.
11. NFPA 70 - National Electric Code.

THROUGH-PENETRATION UL CLASSIFICATION SYSTEM

FIRE STOPPING SYSTEMS

No Penetrating Items:

Metallic Pipes, Conduit or Tubing:

Non-Metallic Pipe, Conduit or Tubing:

Electric Cables:

Cable, Trays with Electric Cables:

Insulated Pipes:

Electrical Busduct Penetrations:

Mechanical Ductwork Penetrations:

Multiple Penetrations Through Common Openings:

Construction Penetration

F- Floor Penetration

W- Wall Penetration

C - Floor or Wall Penetration

Type of Construction

A - Concrete floors equal to or less than 5 inches thick

B - Concrete floors greater than 5 inches thick

J - Concrete or masonry walls equal to or less than 8 inches thick

K - Concrete or masonry walls greater than 8 inches thick

L - Framed Walls

CONSTRUCTION JOINT UL CLASSIFICATION SYSTEM

FIRE-RESISTANT JOINT SYSTEMS

UL CLASSIFICATION SYSTEM

Joint System	Movement Capability	Joint Width			
	Floor-to-Floor	FF	D		0000-0999
	Wall-to-Wall	WW	D		0000-0999
	Floor-to-Wall	FW	D		0000-0999
	Head of Wall	HW	D		0000-0999

MOVEMENT CAPABILITY

D= Dynamic

S= Static

JOINT WIDTH

0000-0999 Less than or equal to 2 inches

1000-1999 Greater than 2 inches less than or equal to 6 inches

2000-2999 Greater than 6 inches less than or equal to 12 inches

1.06 QUALITY ASSURANCE

- A. Fire-Test Response Characteristics: Provide through-penetration fire stop systems and fire resistive joint systems that comply with specified requirements of tested systems.
- B. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall provide and consult with an Florida licensed structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 3000.
- B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- C. Submit material safety data sheets and certificates of compliance provided with product delivered to job-site.
- D. VOC Content Limitations: For firestop system products, submit documentation of conformance with LEED EQ Credit 4.1 "Low-Emitting Materials, Adhesives and Sealants".

1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in project to a single firestop specialty contractor.

1.09 FIELD SERVICES

- A. Contractor shall provide field services as described below. Field services shall be provided by one of the following groups or entities:
 - 1. Firestopping Manufacturer's Field Representative
 - 2. Third Party Firestopping Consultant approved by the firestopping manufacturer to review and approve firestopping installations.
- B. Description of Field Services:
 - 1. During initial installation, firestop manufacturer should be present to assure proper installation/application.
 - 2. Upon completion of all firestopping installation, firestop manufacturer shall review firestopping installed on site and provide written verification to the Architect and Owner that all firestopping materials, systems, and installations are in accordance with manufacturer's recommendations and are appropriate for the type of penetration being sealed and the rating of wall in which the penetrations occur.
 - a. Manufacturer's representative shall be present at the project above ceiling inspection. Provide written verification of firestopping installations to Architect within 7 days of above ceiling inspection.

1.10 SOLE SOURCE REQUIREMENTS

- A. All fire stopping materials shall be provided from a single manufacturer for all trades.
- B. All firestopping installers shall be approved by the manufacturer as a certified applicator of firestopping materials.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.12 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet. For non-water resistant firestop materials, protect from exposure to water- firestop materials that are water resistant shall be protected until fully cured.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN) and perimeter firestop systems (XH DG) listed in Volume 2 of the URL Fire Resistance Directory; provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma (Basis of Design)
 - a. 800-879-8000
 - 2. 3M
 - 3. Tremco
 - 4. STI

2.03 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079, ASTM E 1966, ASTM E 2307 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with non-combustible and/or combustible plastic pipe (closed and open systems), conduit, and/or cable bundles penetrating concrete floors, the following products are acceptable:
 - 1. Hilti CP 680P or CP 680M Cast-In Place Firestop Devices:
 - a. Add Aerator adaptor when used in conjunction with aerator (“sovent”) system.
 - b. Add metal deck adapter kit if utilizing CP 680P or M on corrugated metal deck.
 - c. Add height extension if utilizing CP 680P or M in concrete slabs thicker than 8”.
 - d. Add Hilti Water Module (2” up to 6”) to achieve UL W-Rating
 - e. Add Hilti TOP SEAL (1/2” up to 2”) to achieve UL W-Rating
 - 2. Hilti Toilet Flange for use with floor outlet water closets.
 - 3. Hilti coupling sleeve for use with floor or general purpose drains.
- C. Pre-installed firestop devices containing built-in self-sealing intumescent inserts for use with data and communication cabling which allow for cable adds or changes without the need to remove or replace any firestop materials, the following product is acceptable:
 - 1. Hilti CP 653 Speed Sleeve
- D. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti FS-ONE Intumescent Firestop Sealant
 - 2. Hilti CP 604 Self-leveling Firestop Sealant
 - 3. Hilti CP 620 Fire Foam
 - 4. Hilti CP 606 Flexible Firestop Sealant
 - 5. Hilti CP 601S Elastomeric Firestop Sealant
- E. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti CP 601S Elastomeric Firestop Sealant
 - 2. Hilti CP 606 Flexible Firestop Sealant
 - 3. Hilti FS-ONE Intumescent Firestop Sealant
- F. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
 - 1. Hilti CP 672 Speed Spray
 - 2. Hilti CP 672 FC “FAST CURE” Speed Spray

3. Hilti CP 601S Elastomeric Firestop Sealant
 4. Hilti CP 606 Flexible Firestop Sealant
 5. Hilti CP 604 Self-leveling Firestop Sealant
- G. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material. The following products are acceptable:
1. Hilti CP 677 Speed Plugs
 2. Hilti CP 767 Speed Strips
- H. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
- I. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 620 Fire Foam
 3. Hilti CP 601S Elastomeric Firestop Sealant
 4. Hilti CP 606 Flexible Firestop Sealant
- J. Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti CP 618 Firestop Putty Stick
 2. Hilti CP 658T Firestop Plug
- K. Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti CP 618 Firestop Putty Stick
 2. Hilti CP 658T Firestop Plug
- L. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
1. Hilti CP 617 Firestop Putty Pad
 2. Hilti Firestop Box Insert
 3. Hilti FS 657 FIRE BLOCK
- M. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
1. Hilti CP 643 N Firestop Collar
 2. Hilti CP 644 Firestop Collar
 3. Hilti CP 648E Endless Wrap Strips
 4. Hilti CP 648S Single Wrap Strips
- N. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti CP 637 Firestop Mortar
 2. Hilti FS 657 FIRE BLOCK
 3. Hilti CP 620 Fire Foam
 4. Hilti CP 675T Firestop Board
- O. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti FS 657 FIRE BLOCK
 2. Hilti CP 675T Firestop Board
- P. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti CP 672 Speed Spray
 2. Hilti CP 601S Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant
 4. Hilti CP 604 Self-Leveling Firestop Sealant
- Q. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits or cables is expected, the following products are acceptable:
1. Hilti FS 657 FIRE BLOCK
 2. Hilti CP 658T Firestop Plug
- R. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- S. Provide a firestop system with an Assembly Rating as determined by UL 2079 or ASTM E 1966 which is equal to the time rating of construction joint assembly.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire resistive joint systems are installed according to specified requirements.
- C. Coordinate firestopping with other trades so that obstructions are not placed in the way prior to the installation of the firestop systems.
- D. Do not cover up through-penetration and joint firestop system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 109, IBC 2000.

3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL or Intertek approved systems.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.
 4. Pre-Installation Meeting: Conduct a pre-installation meeting with General Contractor, Architect, Owner's Representative, Florida Bureau of Building Construction or other governing authority, Fire-Specialty Contractor, General Contractor's Fireproofing

Consultant and all major subcontractors (mechanical, plumbing, electrical, fire protection, drywall, etc). The General Contractor shall take notes and distribute to all parties.

3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- E. Manufacturer's Field Services: During initial installation, firestop manufacturer should be present to assure proper installation/application.

3.05 IDENTIFICATION AND DOCUMENTATION

- A. The firestop contractor is to supply documentation in the form of the Hilti FTP "Firestop Tracking Process"
- B. The FTP is to include:
 - 1. Architectural details
 - 2. Firestop Affidavit
 - 3. Firestop System snapshot
 - 4. Installation log
 - 5. Firestop systems
 - 6. IFC Guidelines for Engineering Judgements
 - 7. Product Information of utilized products
 - 8. All other relevant documentation
 - 9. Building code excerpts
 - 10. Copies (electronic) of the FTP are to be provided to the General Contractor, Architect, Inspector and Owner at the completion of the project.
 - 11. Identify through-penetration firestop systems with self-adhesive, preprinted labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - a. Installer/Contractor's name, address and phone number.
 - b. Date of installation.
 - c. Through-Penetration firestop system and manufacturer name.

3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

- A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictional correct per existing trade agreements.

END OF SECTION 07840

**SECTION 079005
JOINT SEALERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

- A. Section 07 2726 - Fluid Applied Membrane Air Barriers.
- B. Section 07 8401 - Firestopping: Firestopping Sealants.
- C. Division 8 - Doors, storefront and louvers
- D. Section 088000 - Glazing: Glazing sealants and accessories.
- E. Section 092116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- D. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 014000.
- B. Refer to 01 4000 and 01 1000

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a the specified warranty periods.
 - 1. Unless noted otherwise, provide manufacturer's standard 10 year material warranty.
 - 2. Provide additional manufacturer's warranties listed for specific products.
- C. Provide General Contractor's Project Joint Sealant Warranty at the back of this specification section. Warranty to be signed by the Joint Sealant Contractor and General Contractor.
- D. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.
- E. Refer to sealant types for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Silicone Sealants:
 - 1. Dow Corning: www.dowcorning.com
 - 2. Pecora Corporation: www.pecora.com.
 - 3. Tremco: www.tremcosealants.com
- B. Polyurethane Sealants:
 - 1. Pecora; www.pecora.com
 - 2. Sonneborn; www.chemrex.com
 - 3. Tremco; www.tremcosealants.com
- C. Acrylic Emulsion Latex Sealants:
 - 1. Pecora Corporation: www.pecora.com.
 - 2. Sonneborn; www.chemrex.com
 - 3. Tremco; www.tremcosealants.com

2.02 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Type I - General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M ; single component, ultra low-mod.
 - 1. Color: To be selected by Architect from manufacturer's full range.
 - 2. Product:
 - a. Dow 790
 - b. Pecora 890
 - c. Tremco Spectrem-1
 - 3. Applications: Use for:
 - a. Vertical and horizontal construction joints between masonry/concrete/stone to masonry/concrete/stone.
 - 4. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- C. Type II - General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component, structural
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Product;
 - a. Dow 795
 - b. Pecora 895
 - c. Tremco Spectrum -2
 - 3. Applications: Use for:
 - a. All other vertical and horizontal construction joints not listed in sealant type I & III.
 - 4. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- D. Type III - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Product: Equal to Backerseal by Emseal
 - 3. Size as required to provide weathertight seal when installed.
 - 4. Applications: Use for:
 - a. Exterior wall expansion joints used in conjunction with Dow 790
- E. Type IV - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type S, single component, paintable.
 - 1. Color: To be selected by Architect from manufacturer's standard range.

2. Product:
 - a. Pecora AC-20
 - b. Tremco Tremflex 834
 - c. Sonneborn Sonolac
 3. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Other interior joints for which no other type of sealant is indicated.
- F. Type V - General Purpose Interior Sealant: Medium Modulus silicone sealant
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Products:
 - a. Dow 795
 - b. Percora 895
 - c. Tremco Spectrem-2
 3. Applications: Use for:
 - a. Joints between aluminum door and window frames and adjacent wall surfaces.
- G. Type VI - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Product:
 - a. Dow 786
 - b. Tremco Tremsil 200
 - c. Pecora 898
 2. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- H. Type VII - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and A; multi- component, type M
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Product:
 - a. Tremco THC 900/901
 - b. Pecora NR-200
 - c. Sonneborn- SL-2
 3. Applications: Use for:
 - a. Expansion joints in floors.
 - b. Joints between hard floor tile and hard floor tile and adjacent wall surfaces for hard tile expansion joints.
- I. Type VIII - Concrete Joint Sealant: Polyurethane; ASTM C 920, Class 25, Uses T, and M; multi- component (type M), Grade NS vertical and horizontal
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Product:
 - a. Sonneborn NP-2
 - b. Pecora Dynatrol-II
 - c. Tremco Dymeric 240 FC
 3. Applications: Use for:
 - a. Joints in sidewalks and curb and gutters
 - b. Joints in concrete walls

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application, and compatible with joint substrates.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

- C. Sealant Backer Rod: Bi- Cellular Polyolefin foam rod equal to SOF ROD/ Nomaco and or Open cell Polyurethane foam equal to Foam Pak II/Nomaco. All backer rods shall be as recommended by sealant manufacture for specific use. Provide size and shape of rod to control joint depth, break bond at the bottom of joint, form optimum shape of bead on back side, and minimize the possibility of extrusion when joint is compressed.
- D. Joint Backing: Round foam rod compatible with sealant; oversized 25 percent larger than joint width.
- E. Tooling Agent: Agent recommended by material manufacturer to ensure contact of material with inner joint faces.
- F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application. Provide self adhering tape where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

PROJECT JOINT SEALANT WARRANTY

PROJECT : _____

LOCATION: _____

OWNER : _____

WATERPROOFING

CONTRACTOR _____

ADDRESS _____

DATE OF ACCEPTANCE _____ **DATE OF EXPIRATION** _____

The Joint Sealant Contractor and General Contractor do hereby certify that the above and underground work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved joint sealants manufacturers' recommendations.

The Joint Sealant Contractor and General Contractor do hereby guarantee the joint sealants and associated work including but not limited to all above and underground vertical and horizontal joint sealants to be water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of ten (10) years (unless noted 20 years in specification), starting on the date of substantial completion of the project. This warranty applied to Section 07 9005, Joint Sealers.

Subject to the terms and conditions listed below, the Joint Sealants Contractor and General Contractor also guarantee that during the guarantee period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the joint sealant manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including.

Anticipated life of the joint sealant systems and the best standards applicable to the particular joint sealant type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within seven (7) calendar days upon proper notification of leaks or defects by the Owner.

During the guarantee period, if the Owner allows alteration of the work by anyone other the Joint Sealant Contractor or General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything affected by, this guarantee shall become null and void upon the date of said alterations.

Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the joint sealant areas, and any damage caused by such addition. If this contract is for joint sealant of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing.

The Owner shall promptly notify the Joint Sealant Contractor or General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Joint Sealant Contractor or General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF,

THIS INSTRUMENT HAS BEEN DULY EXECUTED THIS _____ DAY OF _____(YEAR).

**GENERAL CONTRACTOR'S
AUTHORIZED SIGNATURE**

**JOINT SEALANT CONTRACTOR'S
AUTHORIZED SIGNATURE**

NAME AND TITLE

TYPED NAME AND TITLE

TYPED

Notary Public

END OF SECTION

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
1. 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 01 Section "Sustainable Design Requirements".
 2. Division 01 Section "General Conditions".
 3. Division 04 Section "Masonry".
 4. Division 06 Section "Rough Carpentry".
 5. Division 06 Section "Finish Carpentry".
 6. Division 08 Section "Operations and Maintenance".
 7. Division 08 Section "Flush Wood Doors".
 8. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 9. Division 08 Section "Glazing".
 10. Division 08 Section "Door Hardware".
 11. Division 09 Sections "Painting".
 12. Division 26 Section "Electrical"
- 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. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
 7. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 8. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 9. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 10. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
 11. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 12. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
 13. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.

14. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
15. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Doors Under Specified Pressure Differences Across the Specimens.
16. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
17. ASTM E 413 - Classification for Rating Sound Insulation.
18. ASTM E1332 - Standard Classification for Determination of Outdoor-Indoor Transmission Class.
19. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
20. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
21. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
22. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
23. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
24. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
25. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
26. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
27. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 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.

1.04 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, furnish SDI-Certified manufacturer products that 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 UL10C (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. Hurricane Resistant Exterior Openings (State of Florida including High Velocity Hurricane Zone (HVHZ): Provide exterior hollow metal doors and frames as complete and tested assemblies, or component assemblies, including approved hardware specified under Section 087100 "Door Hardware", to meet the design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.
 1. Each unit to bear third party permanent label in accordance with Florida Building Code requirements.
- F. 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.

1.05 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.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 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.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.02 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.

2.03 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch (44 mm) 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 and ANSI/NAAMM HMMA 867.
- 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 thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum operable thermal rating of 0.35 (0.35)/hr-ft²-F.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch (3.18 mm) in 2 inches (50.8 mm).
 - 5. 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.
 - 6. 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.
 - 7. 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. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch (3.18 mm) in 2 inches (50.8 mm).
 5. 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.
 6. 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.
 7. 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 (C) Polystyrene Core - Legion Series.
 2. Curries Company (CU) - Polystyrene Core - 707 Series.

2.04 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. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M CM G CG Series.
- 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. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - C CM CG Series.
 - b. Curries Company (CU) - M Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 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 (1.07 mm) thick, with corrugated or perforated straps not less than 2 inches (50.8 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch (1.07 mm) thick.
 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches (1.07 mm) thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches (0.41 mm) thick.

2.06 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
1. Blade Type: Vision proof inverted V or inverted Y.

2. Metal and Finish: Galvanized steel, 0.040 inch (1.02 mm) 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 louvers to meet rating indicated.
 2. Metal and Finish: Galvanized steel, 0.040 inch (1.02 mm) thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.07 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 (15.88 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.

2.08 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 (0.41 mm) thick.

2.09 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 (19.05 mm) 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 (457.2 mm) from top and bottom of frame. Space anchors not more than 32 inches (812.8 mm) on-center and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (3048 mm) high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (609.6 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches (457.2 mm) from top and bottom of frame. Space anchors not more than 32 inches (812.8 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2438.4 mm) high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (609.6 mm) or fraction thereof above 96 inches (2438.4 mm) high.
 - 5) Two anchors per head for frames above 42 inches (1066.8 mm) 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".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils (0.0762 mm) DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- 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.

2.10 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

3.01 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.

3.02 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 square, level, twist, and plumb condition.
- 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.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.03 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, leveled, 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 (3.18 mm) plus or minus 1/16 inch (1.59 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.18 mm) plus or minus 1/16 inch (1.59 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.52 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19.05 mm).
 - 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.

3.04 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.

3.05 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

**SECTION 081416
FLUSH WOOD DOORS**

PART 1 GENERAL

- A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, acoustical, and special function.

1.02 RELATED REQUIREMENTS

- A. Section 062000 - Finish Carpentry:
- B. Section 081113 - Hollow Metal Doors and Frames.
- C. Section 087100 - Door Hardware.
- D. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

- A. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- B. AWI (QCP) - Quality Certification Program; Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- E. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).
- H. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- J. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door plastic laminate, 6 by 6 inch (____ by ____ mm) in size illustrating wood grain, stain color, and sheen.
- E. Samples: Submit two samples of door veneer, in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

- D. Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
 - 1. Oshkosh; www.oshkoshdoor.com
 - 2. Ampco Products, Inc; ____: www.ampco.com/#sle.
 - a. Oregon Door; Architectural Series: www.oregondoor.com/#sle.
 - 3. Poncraft Door Co; ____: www.poncraft.com/#sle.
 - 4. VT Industries, Inc; ____: www.vtindustries.com/#sle.
 - 5. Formica Inc.
 - 6. Substitutions: See Section 016000 - Product Requirements.

2.02 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated. **Refer to Finish Schedule for plastic laminate color.**
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at all locations ____.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. High pressure decorative laminate (HPDL) finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating of 35; plies and faces as indicated above. See door schedule for location.

2.04 DOOR FACINGS

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; See Finish Schedule for color; textured, low gloss finish.

- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings Lite Kites: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Provide in the same fire rating as the door and frame where applicable.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

- A. Hollow Metal Door Frames: As specified in Section 081113.
- B. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to match metal door frame color.
 - 2. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
 - 3. Louver Blade: Inverted V blade, sight proof, light proof.
 - 4. Louver Free Area: 50 percent.
 - 5. Fasteners: Concealed fasteners.
- C. Glazing: As specified in Section 088000.
- D. Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

**SECTION 083100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling access door and frame units.
- B. Refer to drawings for additional requirements.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry
- B. Section 09 2116 - Gypsum Board Assemblies
- C. Section 099123 - Interior Painting: Field paint finish.
- D. Section _____: Mechanical components requiring access.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Ceiling and Wall Mounted Units:
 - 1. Location: As Required. Provide where required for access to fire protection, plumbing, mechanical, electrical, etc.
 - 2. Material: Steel.
 - 3. Size in Ceilings: as indicated or as required inches (____ mm), unless otherwise indicated.
 - 4. Door/Panel: Flush, Hinged, standard duty, with tool-operated spring or cam lock and no handle. Perforated door flange when located in Drywall.
 - 5. Tool-operated spring or cam lock; no handle.
 - 6. Fire rating as required.

2.02 MANUFACTURERS

- A. Wall and Ceiling Access Doors:
 - 1. Acudor Products Inc: www.acudor.com., Basis of Design
 - a. **BP-2002 Universal Flush 16 GA metal access door for drywall. Provide concealed hinge, stainless steel screwdriver operated cam latch. Baked White Prime Coat, field finish to match ceiling color.**
 - 2. Karp Associates, Inc: www.karpinc.com.
 - 3. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
 - 4. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Verify with mechanical requirement.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

**SECTION 083301
OVERHEAD COILING COUNTER DOOR**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Electric motor operated rolling counter doors.
- B. Related Sections:
 - 1. 05 5000 Metal Fabrications. Door opening jamb and head members.
 - 2. 06 1000 Rough Carpentry. Door opening jamb and head members.
 - 3. 08 7100 Hardware. Masterkeyed cylinder.
 - 4. 09 9100 Painting. Field painting.
 - 5. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
 - 1. Control Station.

1.02 SUBMITTALS

- A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
 - 1. Product Data.
 - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
 - 3. Physical samples of finishes to be submitted for approval by Architect.
 - 4. Quality Assurance/Control Submittals:
 - a. Provide manufacturer ISO 9001:2015 registration.
 - b. Provide manufacturer and installer qualifications - see below.
 - c. Provide manufacturer's installation instructions.
 - 5. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Certificate stating that installed materials comply with this specification.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years. experience in producing counter doors of the type specified.
 - 2. Installer Qualifications: Manufacturer's approval.

1.04 DELIVERY STORAGE AND HANDLING

- A. Reference Section 01 66 00 Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

1.05 WARRANTY

- A. Standard Warranty: Two (2) years from date of shipment against defects in material and workmanship
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer (Basis of Design or Approved Equal):
 - 1. Cornell: 24 Elmwood Avenue, Mountain Top, PA.
 - 2. Meghan Joseph (727) 318-0929.
 - 3. Cookson.
 - 4. Clopay Building Products.

5. Overhead Door and Fireplace (334) 285-5275.

2.02 PRODUCT INFORMATION

- A. Model: ESC10

2.03 MATERIALS

- A. Curtain:

1. Slat Configuration:
 - a. Galvanized Steel: No. 1F, interlocked flat-faced slats, 1-1/2 inches high by 1/2-inch deep, minimum 22 gauge ASTM A653, commercial quality, galvanized steel with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.

2.04 FINISH:

- A. SpectraShield® Coating System or Approved Equal (Color Selected by Architect):
1. ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, white baked-on base coat and white baked-on polyester finish coat.
 2. Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- B. Shaft Assembly:
1. Tube Motor Shaft Assembly:
Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
 2. Brackets:
Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures.
- C. Finish: To Match Slats
1. Hood: Minimum 24 gauge galvanized steel with reinforced top and bottom edges.
Provide minimum 1/4-inch (6.35 mm) steel intermediate support brackets.
 2. Finish: To Match Slats.

2.05 OPERATION

- A. Electric Tube Motor Operator: Rated for a maximum of 10 cycles per day, cULus recognized, rated (50nm) (100nm) or (200nm) as recommended by door manufacturer for size and type of door, 110 Volts, 1 Phase. Provide complete with electric tube motor, maintenance free electric brake, emergency manual crank hoist and control station(s). Motor shall be protected against overload with an auto-reset thermal sensing device. Operator shall be equipped with an emergency manual crank hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual crank hoist. Operator shall be capable of 10-14 RPM. Fully adjustable, mechanical internal worm limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
- B. Constant pressure to close:
1. No sensing device required.
 2. Key Control access only.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
- C. Commencement of work by installer is acceptance of substrate

3.02 INSTALLATION

- A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
- B. Follow manufacturer's installation instructions

3.03 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

3.04 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer
- B. Remove surplus materials and debris from the site

3.05 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative
- B. Instruct Owner's Representative in maintenance procedures

END OF SECTION

**SECTION 083323
OVERHEAD COILING STORM DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior Overhead Coiling high impact hurricane door

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, component connections and details, and
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, by inches (by mm) in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures, and
- F. Maintenance Data: Indicate lubrication requirements and frequency, periodic adjustments required, and
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer Warranty: Provide five-year manufacturer warranty. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling High Impact Hurricane Doors
 1. Alpine Overhead Doors, Inc; : www.alpinedoors.com/#sle. Redi-Storm
 2. McKeon; www.mckeondoor.com
 3. The Cookson Company; : www.cooksondoor.com/#sle. Storm Defender
 4. Substitutions: See Section 01 6000-Product Requirements.

2.02 COILING DOORS

- A. Exterior Overhead Coiling High Impact Hurricane Door
 1. Capable of withstanding 187 mph winds without undue deflection or damage to components.
 2. Design pressure of +60 psf & -60 psf, 1.5 Safety factor, 90+/- psf
 3. Slat has been missile tested to ensure safety against flying debris

4. Weather seals consist of a neoprene hood baffle, vinyl guide weather stripping and vinyl astragal on the bottom bar
5. Finish: Factory painted, color.
6. Electric Motor Operated
7. **Mounting: As indicated on drawings.**
8. Locking Devices: Lock and latch handle on outside.

2.03 MATERIALS AND COMPONENTS

- A. Metal Curtain Construction: Interlocking slats.
 1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
 3. Steel Slats: Minimum thickness, gauge, inch (mm); ASTM A653/A653M galvanized steel sheet.
- B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

END OF SECTION

**SECTION 084313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide high performance sill flashing (weeps spacing per manufacturer) with Sealed manufacturers end dams by manufacturer. Set sill in full bed of sealant. Provide manufacturers jamb closures.
- B. Door hardware.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.
- B. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2020, with Errata (2022).
- C. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- J. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).
- K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and _____.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 30' by 48 inches (____ by ____ mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials. with jamb, head, sill utilizing all specified components, see para 1.01 A.

- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Warranty: Submit manufacturer five year warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Installation instructions of manufacturer's system.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. The contractor shall be responsible for coordinating and holding a pre-installation conference. The required attendees shall be the Contractor, all related sub-contractors, the waterproofing subcontractor, project manager, and superintendent, and the waterproofing manufacturer's representative, the Owner, and Architect. Topics to be discussed include, but are not limited to delivery dates, specialty contractor skill sets and capabilities, work schedules, and approved submittals.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

- A. IR 521T Framing System Impact Resistant and Blast Mitigation
 - 1. Basis of Design: Equal to Kawneer
 - 2. 2-1/2" x 5" (63.5 mm x 127 mm) nominal dimension
 - 3. Thermally Broken
 - 4. Center Plane
 - 5. 1-5/16" (33.4 mm) impact resistant glazing
 - 6. Screw Spline Fabrication
- B. Center-Set Style
 - 1. Basis of design: Equal to Kawneer 450 Series
 - 2. Mullion Dimensions: 1 3/4 inches wide by 4-1/2 inches deep.
 - 3. Non-Thermally Broken

2.02 MANUFACTURERS

- A. Aluminum-Framed Storefront and Doors:
 - 1. Coral Architectural Products, a division of Coral Industries, Inc; ____:
www.coralap.com/#sle.

2. EFCO Corporation; ____: www.efcocorp.com/sle.
3. Kawneer North America; ____: www.kawneer.com. Basis of Design
4. Oldcastle BuildingEnvelope; ____: Series 300 multiplane
5. YKK AP America Inc; ____: www.ykkap.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

2.03 STOREFRONT

1. Exterior Glazing Rabbet: For 1 - 5/16" insulating glazing.
 2. Interior Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.
 3. Finish: Class 1 anodized .
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 4. Finish Color: clear.
- B. Performance Requirements:
- a. Design Wind Loads: Comply with requirements of ASCE 7.
 2. Water Penetration Resistance: The test specimen shall be tested in accordance with ASTM E 331. No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
 - a. There shall be no leakage at a minimum static air pressure differential of 15 psf (720 Pa) as defined in AAMA 501.
 3. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
 4. Impact Resistance: The test specimen shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
 - a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.
 5. Thermal Resistance: Overall U-Value Including Glazing: Metal Framed Entrance Door = .77 Max; Metal Framing Fixed = .5.
 - a. Solar heat gain, reference SHGC; .25 Max.

2.04 COMPONENTS

1. Cross-Section: As indicated on drawings.
 2. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 088000.
- C. Swing Doors: Glazed aluminum - Non-Thermally Broken
1. Thickness: 1-3/4 inches .
 2. Top Rail: [5"] inches ([] mm) wide.
 3. Vertical Stiles: [5"] inches ([] mm) wide.
 4. Bottom Rail: 10 inches (254 mm) wide.
 5. Glazing Stops: Beveled.
 6. Finish: Same as storefront.
 7. Equal to Kawneer 500 Wide Stile Entrance

2.05 MATERIALS

- A. Glazing Accessories: As specified in Section 088000.
- B. Provide (High Performance) extruded aluminum manufacturer's storefront frame sill, with incorporated screw-applied end dams, ensuring positive engagement and tight joints between the sill flashing and end dam. Seal all joints of end dams and fastener penetrations with

manufacturer recommended sealant. Provide weeps and under sill sealant as recommended by manufacturer.

- C. Provide manufacturer's continuous snap trim closure components at all head and jambs.

2.06 FINISHES

- A. Anodized Finish, Class 1 exterior, color as selected by architect.
- B. Color: As selected by Architect from manufacturer's standard range.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 HARDWARE

- A. For each door, include weatherstripping and sill sweep strip.
- B. Other Door Hardware: As specified in Section 08 7100 - Door Hardware.
- C. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all exterior doors and the following interior doors:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
 - 1. See Section 087100 for hardware installation requirements.
- K. Install glass in accordance with Section 088000, using glazing method required to achieve performance criteria.
- L. Install perimeter sealant in accordance with Section 07 9200.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Test installed storefront for water leakage in accordance with AAMA 501.2 hose test.
- C. Test 100 linear feet of exterior storefront systems installed with perimeter sealant cured. If test fails, retest the 100 linear feet plus additional linear feet as selected by the Architect/Waterproof Consultant. Additional testing shall be the glazing subcontractors responsibility.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

**SECTION 084413
GLAZED ALUMINUM CURTAIN WALLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed curtain wall, with vision glazing.

1.02 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Steel attachment members.
- B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 084313 - Aluminum-Framed Storefronts: Entrance framing and doors.
- D. Section 088000 - Glazing.
- E. Section 092116 - Gypsum Board Assemblies:

1.03 REFERENCE STANDARDS

- A. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.
- D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- J. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2026.
- K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).
- L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, _____, and infill.

- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples: Submit two samples ____by____ inches (____by____ mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.
- E. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least ____ five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a 10 year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide 15 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

- A. 1600 Wall System 1 Curtain Wall impact resistant (IR):
 - 1. Thermally-Broken
 - 2. Sight line: 2-1/2" (63.5 mm)
 - 3. Outside-glazed pressure plate format
 - 4. System depth:
 - a. 7-13/16" (198.4 mm) for 1-5/16" (33.3 mm) insulating glazing
- B. 1600 Wall System 1 Curtain Wall with Internal Steel
 - 1. Non Thermally-Broken
 - 2. System Depth:
 - a. 7-1/2" (190.5) for 9/16" (14.3 mm) non-insulated glazing and 5/8" (15.9 mm) monolithic glazing

2.02 MANUFACTURERS

- A. Basis of Design: Kawneer North America; www.kawneer.com
- B. Oldcastle Building Envelope Reliance Series
- C. YKK AP

2.03 SUBSTITUTIONS: SEE SECTION 016000 - PRODUCT REQUIREMENTS.

- A. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.04 CURTAIN WALL

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Fabrication Method: Either shop/factory or field fabricated system.
 - 2. Finish: High performance organic coatings to match storefront
 - a. Factory finish surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - 3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 6. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - a. Include snap-on aluminum trim that conceals fasteners. Trim to provide a deeper profile of at least 1 inch. Intent is to match the storefronts exterior aesthetics in regards to mullion exterior face to glazing setback.
 - 7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Structural Performance Requirements: Design and size components as required and reinforced as required to support imposed loads.
 - 1. Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
 - b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
 - c. Movement of curtain wall relative to perimeter framing.
 - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly:
 - 1. Static:
 - a. The test specimen shall be tested in accordance with ASTM E 331.
 - b. There shall be no leakage at a minimum static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.
 - 2. Dynamic:
 - a. The test specimen shall be tested in accordance with AAMA 501.1.
 - b. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

- D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.27 psf (300 Pa) pressure difference across assembly.
- E. Windborne-Debris-Impact Resistance Performance:
 - 1. Performance shall be tested in accordance with TAS 201/203, ASTM E1886 and information in ASTM E1996:
 - a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
- B. Glazing: See Section 088000.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
 - 1. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- D. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- G. Glazing Accessories: See Section 088000.
- H. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.07 FINISHES

- A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

2.08 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.
- D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion.
 3. Preparation includes, but is not limited to, cleaning and priming surfaces.
 4. Seal joints watertight unless otherwise indicated.
 5. Install glazing to comply with requirements in Section 088000 "Glazing."
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 1/2" inch (____ mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

- B. Provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 - 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- C. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

**SECTION 085654
SERVICE WINDOWS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Self-closing transaction windows with transom.

1.02 RELATED SECTIONS

- A. Section 042000 - Unit Masonry.
- B. Section 047200 - Cast Stone Masonry
- C. Section 076200 - Sheet Metal Flashing and Trim.
- D. Section 079005 - Joint Sealants.

1.03 REFERENCES

- A. ASTM A 240 – Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
- B. ASTM A 653 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM B 209 – Aluminum and Aluminum-Alloy Sheet and Plate.
- D. ASTM B 221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. ASTM C 1036 – Standard Specification for Flat Glass.
- F. ASTM C 1048 – Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM E 773 – Accelerated Weathering of Sealed Insulating Glass Units.
- H. ASTM E 774 – Classification of the Durability of Sealed Insulating Glass Units.
- I. ASTM F 1233 – Security Glazing Materials and Systems.
- J. UL 752 – Bullet-Resisting Equipment.

1.04 SUBMITTALS

- A. Comply with Section 013300 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, glazing, fasteners, hardware, finish, electrical wiring diagrams, options, and accessories.
- D. Samples: Submit manufacturer's samples of standard finishes.
- E. Operation and Maintenance Manual: Submit manufacturer's operation and maintenance manual, including operation, maintenance, adjustment, and cleaning instructions, trouble shooting guide, parts list, and electrical wiring diagrams.
- F. Warranty: Submit manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Minimum of 10 years successful experience continuously manufacturing pass-thru windows.
- B. System Design: Design and size components to withstand dead loads and live loads caused by pressure and negative wind loads acting normal to plane of window as calculated in accordance with applicable code.
- C. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within system, to exterior by weep drainage network.

- D. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

1.07 WARRANTY

- A. Furnish manufacturer's standard warranty document, executed by an authorized officer in which manufacturer agrees to repair or replace windows, components, and accessories that fail in materials or workmanship within specified warranty period. This warranty is in addition to, and not a limitation of other rights Owner has under the contract.
 - 1. Warranty Period:
 - a. One year parts and labor from date of installation.
 - 2. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - b. Structural failures including deflections exceeding 1/4 inch.
 - c. Failure of welds.
 - d. Excessive air leakage.
 - e. Faulty operation of sliding window hardware.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design or Approved Equal:
 - 1. Quikserv, Inc.
 - 2. Ready Access, Inc.

2.02 SELF-CLOSING TRANSACTION WINDOWS WITH TRANSOM

- A. Self-closing transaction window with horizontal sliders meeting all health code requirements.
 - 1. Window Dimensions (nominal): Custom size as indicated on drawings
 - 2. Transom Dimensions (nominal): Custom size as indicated on drawings
 - 3. Overall Dimensions (nominal): Custom size as indicated on drawings
 - 4. Service Panel Operation: Manual open, with hands-free gravity close.
 - 5. Service Panel Type: Sliding, 1 panel
 - 6. Opening Direction: See drawings.
 - 7. Frame: Extruded aluminum, ASTM B 221, Alloy 6063-T6.
 - 8. Aluminum Sheet: ASTM B 209, Alloy 5005-AQ-H34.
 - 9. Galvanized Steel Sheet: ASTM A 653, G90.
 - 10. Fasteners: Stainless steel rivets and hex-head zinc-plated self-threading machine screws.
 - 11. Handle: Stainless steel.
 - 12. Latch & Lock: Self latches every time services opening closes, and equipped with thumb turn lock, and night locking bar.
 - 13. Sill: Track free bottom sill angled toward outside for drainage towards exterior.
 - 14. Glazing:
 - a. 1-inch tempered insulated glass, ASTM E 773 and E 774.
 - b. Solarban 70 Low-E Coating at window locations determined by Architect.

2.03 FABRICATION

- A. Assembly: Factory assembled, factory glazed.

2.04 ALUMINUM FINISH

- A. Anodized: Clear, AA-M10-C12-C22-A31, ASTM B 680 as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive pass-thru windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Ensure openings to receive windows are plumb, level, square, accurately aligned, correctly located, and in tolerance.

3.03 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows plumb, level, square, true to line, and without warp or rack.
- C. Install window components weathertight.
- D. Anchor windows securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.
- E. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- F. Sheet Metal Flashing: Install sheet metal flashing as specified in Section 076200.
- G. Joint Sealants: Install joint sealants as specified in Section 079005.
- H. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- I. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.04 ADJUSTING

- A. Adjust movable service panels to be weathertight in closed position.
- B. Adjust movable service panels to function properly and for smooth operation without binding.

3.05 CLEANING

- A. Clean windows promptly after installation in accordance with manufacturer's instructions.
- B. Remove excess joint sealant in accordance with sealant manufacturer's instructions.
- C. Do not use harsh cleaning materials or methods that would damage glazing or finish.

3.06 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, pass-thru windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 01 Section "General Conditions".
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 08 Section "Operations and Maintenance".
 - 5. Division 08 Section "Hollow Metal Doors and Frames".
 - 6. Division 08 Section "Flush Wood Doors".
 - 7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
 - 3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
 - 4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
 - 5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
 - 6. ICC/IBC - International Building Code.
 - 7. NFPA 70 - National Electrical Code.
 - 8. NFPA 80 - Fire Doors and Windows.

9. NFPA 101 - Life Safety Code.
10. NFPA 105 - Installation of Smoke Door Assemblies.
11. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of tornado or hurricane storm shelter assemblies.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Hurricane Resistant Exterior Openings (State of Florida including the High Velocity Hurricane Zone (HVHZ)): Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.
1. Each unit to bear third party permanent label in accordance with the Florida Building Code requirements.
- G. Each unit to bear third party permanent label indicating compliance with the referenced testing 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 according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 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".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and 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.

1.8 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. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
 - a. Ives (IV) - 5BB Series, 5-knuckle.
 - b. McKinney (MK) - TA/T4A Series, 5-knuckle.
 - c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum

overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
2. Manufacturers:
 - a. Ives (IV).
 - b. Pemko (PE).

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Door Controls International (DC).
 - c. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.

4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. 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. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Manufacturer's Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

2.7 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
- b. Corbin Russwin Hardware (RU) - ML2000 Series.
- c. Sargent Manufacturing (SA) - 8200 Series.

2.8 DEADLOCKS AND LATCHES

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

- a. ASSA ABLOY ACCENTRA (YA) - 350 Series.
- b. Corbin Russwin Hardware (RU) - DL4000 Series.
- c. Sargent Manufacturing (SA) - 4870 Series.

2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. Exit devices shall have a five-year warranty.
 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
 - b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - c. Sargent Manufacturing (SA) - 80 Series.
- C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat

treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7050 Series.
 - b. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

D. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Five-year limited warranty for mechanical features.

2.11 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron 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. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
 - b. Corbin Russwin Hardware (RU) - DC6000 Series.
 - c. Norton Rixson (NO) - 7500 Series.
 - d. Sargent Manufacturing (SA) - 351 Series.

- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
 - b. Corbin Russwin Hardware (RU) - Unitrol Series.
 - c. Norton Rixson (NO) - Unitrol Series.

2.12 OVERHEAD CONCEALED DOOR CLOSERS

- A. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) listed overhead concealed door closers designed for narrow profile frames and doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide overhead concealed doors closers with functions and features as follows:
 - a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies and A117.1 Accessibility Code.
 - b. Single acting, offset hung with a cast iron body.
 - c. Fully concealed body in the frame head and track assembly in the door.
 - d. Separate and independent valves for closing speed and backcheck adjustments.
 - e. Five-year limited warranty.
2. Manufacturers:
 - a. Norton Rixson (NO) - 91DCP Series.

2.13 ARCHITECTURAL TRIM AND ACCESSORIES

- A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1" less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:
 - a. Meets ADA requirements for smooth bottom door surfaces.
 - b. UL Classified options for use on fire-rated doors up to 3 hours.
 - c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
 - d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
 - e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
 - f. Fasteners included; adhesive-backed options available for select models.
 - g. Ten-year limited warranty.
2. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hager Companies (HA).
 - c. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

- A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hager Companies (HA).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).
- B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (NO).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and

provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).
 - 2. Reese Enterprises, Inc. (RE).
 - 3. Zero (ZE).

2.16 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.

2.17 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.
- B. Paint prime coated mullions to match frames.
- C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- D. 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.

- E. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- G. 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 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.

3.5 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. YA - ASSA ABLOY ACCENTRA
4. RO - Rockwood
5. AD - Adams Rite
6. NO - Norton Rixson
7. OT - Other

Hardware Sets

Set: 1.0

Doors: 101A, 121A

Description: EXT - PR - AL - PANIC

2 Continuous Hinge	CFMXXHD1-M		PE
1 Surface Vert Rod Exit, Exit Only	7170WS EO	630	YA
1 Surface Vert Rod Exit, Nightlatch	7170WS 121NL	630	YA
2 Door Pull [Offset}	RM3310-24	US32D	RO
2 Concealed Closer	91N	626	NO
2 Gasketing	by door / frame mfg		
2 Sweep	345AV TKSP		PE
1 Threshold	2005AV MSES25SS		PE

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes.

Set: 2.0

Doors: 106, 127A

Description: EXT - AL - PANIC

1 Continuous Hinge	CFMXXHD1-M		PE
1 Rim Exit Device, Nightlatch	7150WS 121NL	630	YA
1 Door Pull [Offset}	RM3310-24	US32D	RO

1 Concealed Closer	91N	626	NO
1 Gasketing	by door / frame mfg		
1 Sweep	345AV TKSP		PE
1 Threshold	2005AV MSES25SS		PE

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes.

Set: 3.0

Doors: 125C, 125D, 125E

Description: EXT - PR - PANIC - AP

6 Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Surface Vert Rod Exit, Exit Only	7170WS EO	630	YA
1 Surface Vert Rod Exit, Nightlatch	7170WS 121NL	630	YA
2 Door Pull [Offset}	RM3310-24	US32D	RO
2 Surface Closer / Stop	UNI4400 TBGN	689	YA
2 Armor Plate	K1050 WS 36" X 1" LDW CSK TEK	US32D	RO
1 Astragal	303AS TKSP		PE
1 Rain Guard	346C x LAR		PE
1 Gasketing	S88BL		PE
2 Sweep	345AV TKSP		PE
1 Threshold	2005AV MSES25SS		PE

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes.

Set: 4.0

Doors: 119B

Description: EXT - PR - STOR - AP

6 Hinge	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
2 Surface Bolt	988Y		YA
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	PBR 8840FL	626	YA
1 Coordinator [W/mtg plates]	2672 x Mtg Brkts	Black	RO
2 Surface Closer / Stop	UNI4400 TBGN	689	YA
2 Armor Plate	K1050 WS 36" X 1" LDW	US32D	RO
2 Door Stop	467-RKW	Black	RO

1 Astragal	357SP TKSP X S88BL	PE
1 Gasketing	S88BL	PE
2 Sweep	345AV TKSP	PE
1 Threshold	2005AV MSES25SS	PE

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes.

Set: 5.0

Doors: [107A](#), [108A](#), [108C](#), [109A](#)

Description: PR - PANIC - CLASS - SVR

6 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Surface Vert Rod Exit, Exit Only	7170 LBR EO	630	YA
1 Surface Vert Rod Exit, Classroom	7170 LBR PB626F	630	YA
1 Surface Closer / Stop	UNI4400 TBGN	689	YA
2 Kick Plate	K1050 10" x 1" LDW CSK TEK	US32D	RO
2 Door Stop	409 / 446 [aa required]	US26D	RO
2 Silencer	608		RO

Set: 6.0

Doors: [125A](#), [125B](#)

Description: PR - PANIC - CLASS - AP

6 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Surface Vert Rod Exit, Exit Only	7170 LBR EO	630	YA
1 Surface Vert Rod Exit, Classroom	7170 LBR PB626F	630	YA
2 Surface Closer / Stop	UNI4400 TBGN	689	YA
2 Armor Plate	K1050 36" X 1" LDW CSK TEK	US32D	RO
2 Door Stop	409 / 446 [aa required]	US26D	RO
2 Silencer	608		RO

Set: 7.0

Doors: 101B, 121B

Description: PR - AL - PP

2 Continuous Hinge - [Modular]	CFMXXHD1-M		PE
4 Door Pull	RM3300-24	BSP	RO
2 Door Stop	409 / 446 [aa required]	US26D	RO

1 Gasketing by door / frame mfg

Set: 8.0

Doors: [124](#)

Description: PR - STOR - OHS - AP

6 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555	US26D	RO
1 Storeroom or Closet Lock	PBR 8805FL	626	YA
2 Surface Overhead Stop	9-336	630	NO
2 Armor Plate	K1050 36" X 1" LDW CSK TEK	US32D	RO
2 Silencer	608		RO

Set: 9.0

Doors: [109C](#)

Description: PANIC - CLASS

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Rim Exit Device, Classroom	7100 PB626F	630	YA
2 Surface Closer	4400 R / PA TBGN	689	YA
1 Kick Plate	K1050 10" X 1" LDW	US32D	RO
1 Door Stop	409 / 446 [aa required]	US26D	RO
3 Silencer	608		RO

Set: 10.0

Doors: [107B](#), [108B](#), [109B](#), [116](#), [119A](#)

Description: STOR

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom or Closet Lock	PBR 8805FL	626	YA
1 Door Stop	409 / 446 [aa required]	US26D	RO
3 Silencer	608		RO

Set: 11.0

Doors: [117](#)

Description: JAN

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom or Closet Lock	PBR 8805FL	626	YA

1 Mop Plate	K1050 4" x 1" LDW CSK TEK	US32D	RO
1 Door Stop	409 / 446 [aa required]	US26D	RO
3 Silencer	608		RO

Set: 12.0

Doors: [120A](#)

Description: CLASS

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	PBR 8808FL	626	YA
1 Door Stop	409 / 446 [aa required]	US26D	RO
3 Silencer	608		RO

Set: 13.0

Doors: [122](#), [123](#)

Description: OFFICE

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Entry Lock	PBR 8807FL	626	YA
1 Door Stop	409 / 446 [aa required]	US26D	RO
1 Silencer	608		RO

Set: 14.0

Doors: 103, 104, 105

Description: AL - OFF

1 Continuous Hinge - [Modular]	CFMXXHD1-M		PE
1 Mortise Lock	2190 Trim 01-Curve X 4066	US32D	AD
1 Door Stop	409 / 446 [aa required]	US26D	RO
1 Gasketing	by door / frame mfg		

Set: 15.0

Doors: [112](#), [118](#)

Description: TOIL

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	PBR 8802FL V21	626	YA
1 Surface Closer	4400 R / PA TBGN	689	YA
1 Kick Plate	K1050 10" X 1" LDW	US32D	RO
1 Mop Plate	K1050 4" X 1" LDW	US32D	RO

1 Gasketing	S88BL		PE
1 Coat Hook	RM822	BSP	RO

Set: 16.0

Doors: 114A, 114B, 115A, 115B

Description: RESTROOM

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Deadlock	357	626	YA
1 Pull Plate	BF 110 x 70C	US32D	RO
1 Push Plate	71E [6 X 16]	US32D	RO
1 Surface Closer	4400 R / PA TBGN	689	YA
1 Mop Plate	K1050 4" x 1" LDW CSK TEK	US32D	RO
1 Kick Plate	K1050 10" X 1.5" LDW CSK TEK	US32D	RO
1 Door Stop	409 / 446 [aa required]	US26D	RO
1 Gasketing	S88BL		PE

Set: 17.0

Doors: 110, 111

Description: LOCKER

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Deadlock	357	626	YA
1 Pull Plate	BF 110 x 70C	US32D	RO
1 Push Plate	71E [6 X 16]	US32D	RO
1 Surface Closer	4400 R / PA TBGN	689	YA
1 Kick Plate	K1050 10" X 1.5" LDW CSK TEK	US32D	RO
1 Kick Plate	K1050 36" X 1.5" LDW CSK TEK	US32D	RO
1 Door Stop	409 / 446 [aa required]	US26D	RO
1 Gasketing	S88BL		PE

Set: 18.0

Doors: 120B, 120C, 120D

Description: OH DOOR

1 HBO	All hardware By door mfg
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Set: 19.0

Doors: 126A, 126B, 126C, 127B

Description: CASSED

1 Hardware

Not Required

OT

Set: 20.0

Doors: 121R, 121S

Description: CANNOT LOCATE

2 Silencer

608

RO

END OF SECTION 087100

**SECTION 088000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry.
- B. Section 07 2726 - Fluid-Applied Membrane Air Barriers.
- C. Section 07 9005 - Joint Sealers: Sealant and back-up material.
- D. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors.
- E. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- F. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished by storefront manufacturer.
- G. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing furnished by wall manufacturer.
- H. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- L. GANA (GM) - GANA Glazing Manual 2008.
- M. GANA (SM) - GANA Sealant Manual 2008.
- N. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples by 12 inch (by 12 mm) in size of glass units.

- E. Manufacturer's Certificate: Certify that sealed insulated glass meets or exceeds specified requirements.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

- A. Type IG-1 - Sealed Insulating Glass Units: +/-1" thick Vision glazing.
 - 1. Application: All exterior glazing unless otherwise indicated.
 - 2. Outboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: Crystal Gray.
 - b. Coating: Low-E type, on #2 surface.
 - c. Coating Type: Guardian Sunguard SNX 60+, or Vitro Solarban 70 meeting below requirements.
 - 3. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm).
 - a. Tint: Clear.
 - 4. Total Visible Light Transmittance: 60
 - 5. Total Solar Heat Gain Coefficient: 0.24 (Glass Alone)
 - 6. Total U-Value: .238
 - 7. Whole window or door Assembly maximum solar heat gain coefficient: .23
 - 8. Glazing Method: Gasket.

2.02 GLAZING UNITS

- A. Type S-1 - Single Vision Glazing:
 - 1. Application: All interior glazing unless otherwise indicated.
 - 2. Type: Fully tempered float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch (6 mm).
 - 5. Glazing method: Gasket.
- B. Type S-2 - Single Vision Safety Glazing
 - 1. Application: Interior safety glazing at gymnasium.
 - 2. Type: 9/16 inch tempered laminated glass (fully tempered float glass, 1/4 inch + 0.060 PVB + fully tempered float glass, 1/4 inch).
 - 3. Tint: Clear.
 - 4. Glazing method: Gasket.

2.03 EXTERIOR GLAZING ASSEMBLIES

- A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
 - 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 - 3. Glass thicknesses listed are minimum.
- B. GLASS MATERIALS
 - 1. Float Glass Manufacturers:
 - a. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
 - b. Guardian Industries Corp: www.sunguardglass.com/#sle.
 - c. Pilkington North America Inc: www.pilkington.com/na.
 - d. VITRO, Formally PPG
 - e. Oldcastle Building Envelope
 - f. Cardinal Glass Industries (www.cardinalcorp.com)
 - g. Substitutions: Refer to Section 01 6000 - Product Requirements.
 - 2. Float Glass: Provide float glass based glazing unless noted otherwise.
 - a. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 - b. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
 - c. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
 - d. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.04 SEALED INSULATING GLASS UNITS

- A. Sealed Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Edge Spacers: Aluminum, bent and soldered corners.
 - 3. Edge Seal: Glass to elastomer.
 - 4. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

- A. Manufacturers:
 - 1. Bostik Inc: www.bostik-us.com/#sle.
 - 2. Pecora Corporation: www.pecora.com/#sle.
 - 3. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com/#sle.
 - 4. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.06 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
 - c. Dow Chemical.
 - d. Substitutions: Refer to Section 01 6000 - Product Requirements.

- D. Glazing Splines: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; Black color.

2.07 GLAZING IDENTIFICATION

- A. **Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.**

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

- A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 FIELD QUALITY CONTROL

- A. Glass product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

**SECTION 088300
MIRRORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass mirrors.
 - 1. Tempered safety glass.

1.02 RELATED REQUIREMENTS

- A. Section 102800 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- H. GANA (GM) - GANA Glazing Manual; 2022.
- I. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and _____ for glazing installation methods.
- B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

- A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mirrors:
 - 1. Binswanger Mirror/ACI Distribution; ____: www.binswangerglass.com/#sle.
 - 2. Lenoir Mirror Co; ____: www.lenoirmirror.com/#sle.
 - 3. Trulite Glass and Aluminum Solutions; ____: www.trulite.com/#sle.
 - 4. Walker Glass Company Ltd; Walker Glass Mirrors: www.walkerglass.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
 - 1. Thickness: 1/4 inch (6.4 mm).
 - 2. Edges: Arrised.
 - 3. Size: As indicated on drawings.

2.03 ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.
- C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.
- D. Glazing Clips: Manufacturer's standard type.
- E. Mirror Attachment Accessories: Stainless steel J-profile channels at perimeter of mirror as shown on drawings.
- F. Prior to installation, verify that concealed wood blocking has been installed for support of mirrors in cavity of metal stud walls. Fasten glazing channels securely to wood blocking.
- G. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

END OF SECTION

**SECTION 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. **All products and procedures must meet the manufacturer's required criteria for installation.**
- B. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
 - 1. **Section 03 3680 - Concrete Polishing and Dyeing**
 - 2. **Section 09 6519 - Resilient Tile Flooring**
 - 3. **Section 09 3000 - Tiling**
 - 4. **Section 09 6460 - Wood Athletic and Sports Flooring**
 - 5. **Section 09 2123 - Interior Painting Painting: Concrete Clear Sealers**
 - 6. **Section 12 4813 - Entrance Floor Mats and Frames**
 - 7. All other floor finishes as specified in individual sections.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
- F. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

1.02 RELATED REQUIREMENTS

- A. Section 014000 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 033000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Copies of specified test methods.
 - 4. Recommendations for remediation of unsatisfactory surfaces.

5. Submit report to Architect, owner, owner's representative
6. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Owner when specified ambient conditions have been achieved and when testing will start.
 6. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 EXECUTION

2.01 CONCRETE SLAB PREPARATION

- A. PROPER SURFACE PREPARATION INCLUDES THE FOLLOWING:
 1. Inspection of the existing concrete substrate
 2. Removal of existing floor coatings
 3. Decontamination of the concrete surface
 4. Creation of surface profile
 5. Repair of surface irregularities
- B. INSPECTION OF THE EXISTING CONCRETE SUBSTRATE
 1. Inspect the existing concrete substrate to determine its general condition, soundness, presence of contaminants, existing floor coating, presence of moisture vapor emissions and the best methods to use in preparation of the surface to meet the requirements of the project.
- C. DECONTAMINATION OF THE CONCRETE SURFACE
 1. Decontamination of the concrete surface requires the removal of oils, grease, wax, fatty acids and other contaminants, and may be accomplished by the use of detergent scrubbing with a heavy duty cleaner/degreaser, low pressure water cleaning (less than 5,000 psi), steam cleaning, or chemical cleaning. The success of these methods is dependent upon the depth of penetration of the contaminant; which is completely dependent upon the contaminant's viscosity, the concrete's permeability and the duration of exposure. Special care should be taken when preparing concrete at an "in use" facility for repair, replacement or an initial floor topping.
 2. Test concrete substrate for moisture vapor emission using test methods recommended by manufacturer of flooring system being installed.
- D. CREATION OF SURFACE PROFILE

1. A. Creation of surface profile can be accomplished by a number of methods each utilizing a selection of tools, equipment and materials to accomplish the intended purpose, (See METHODS OF SURFACE PREPARATION below). Selection is dependent upon the type of surface to be prepared and the type of system to be installed. In addition, floors, trenches each have their own particular requirements. The type and thickness of the selected flooring system also plays an important role in the selection process. Regardless of the method selected or tools employed, the contractor must provide a surface that will accept the application of flooring products and allow the mechanical bond of the flooring system securely to the concrete. The type of service the structure will be subjected to, will also help to define the degree of profile required. The surface profile is the measure of the average distance from the peaks of the surface to the valleys as seen through a cross sectional view of the surface of the concrete.
2. This dimension is defined pictorially and through physical samples in the ICRI Technical Guideline No 03732, and is expressed as a Concrete Surface Profile number (CSP 1-9).
3. Methods of Surface Preparation
 - a. Depending upon conditions of the concrete one or more methods of surface preparation may be required. It is common for decontamination to precede mechanical preparation, and if necessary a second decontamination to follow.
 - b. The preferred methods for creation of a surface profile, including the removal of dirt, dust, laitance and curing compounds, is steel shotblasting, abrasive (sand) blasting or scarifying. The steel shotblasting or vacuum blasting process is commonly referenced by equipment brand names, such as, Blastrac, Vacu-Blast, Shot-Blast, etc. Vertical and overhead surfaces, such as cove base, wall, and ceiling surfaces shall be prepared utilizing methods of grinding, scarifying, abrasive (sand) blasting, needle scaling, or vertical steel shotblasting. The following table provides a guide for the degree of surface profile required for the coating or overlay to be applied and the preparation methods used to generate each profile. Provide written instruction from manufacturer to architect regarding profile requirements and recommended method for achieving profile.

Application	Profile	Preparation
Sealers	0-3 mils	Detergent scrub Low-pressure Water Acid Etching (not recommended) Grinding
Thin Film	4-10 mils	Grinding Abrasive Blast Steel Shot Blast
High Build	10-40 mils	Abrasive Blast Steel Shot Blast Scarifying
Self-Leveling	50 mils-1/8 inch	Abrasive Blast Steel Shot Blast Scarifying Needle Scaling
Polymer Overlay	1/8-1/4 inch	Abrasive Blast Steel Shot Blast Scarifying Needle Scaling Scabbling Flame Blasting Milling/rotomilling

4. Other surface preparation methods are mentioned in ADDITIONAL SURFACE PREPARATION REFERENCES.
- E. REPAIR OF SURFACE IRREGULARITIES
1. Repair of surface irregularities including bugholes, spalls, cracks, deteriorated joints, slopes, areas near transition zones, such as around drains, floor boxes, doorways, etc. must be repaired prior to the placement of the flooring system and/or the system must be designed to off-set the thickness of the irregularities. For bugholes and other minor surface irregularities, fill using materials recommended by manufacturer of flooring

system. For treatment of cracks and joints refer to the section below entitled "Crack Isolation".

F. CRACK ISOLATION

1. The performance of elastomeric products, requires a relatively uniform dry film thickness to resist drying shrinkage and thermal movement of the concrete, while maintaining a seamless bridge or seal over the concrete. Therefore it is critical that all mortar splatter, protrusions, ridges, penetrations, or sharp projections in the surface of the concrete, be ground smooth or otherwise made smooth, in addition to the normal surface preparation outlined above.
2. Prior to application of an elastomeric system, control/contraction joints, construction joints, and cracks should be sealed with the selected system flexible sealant as recommended by manufacturer of flooring system. This coating should extend a minimum of 6" on either side of the joint or crack. The entire surface area should then receive the specified crack isolation system. Isolation and/or expansion joints should be detailed in accordance with the floor system manufacturer's recommendations.
3. General Polymer systems can be applied to a variety of substrates if the substrate is properly prepared. Preparation of surfaces other than concrete or steel, such as wood, concrete block, brick, quarry tile, glazed tile, cement terrazzo, vinyl composition tile, plastics and existing polymer systems, can be accomplished to receive bonded polymer sealers, coatings, or toppings. For questions regarding a substrate other than concrete or steel, or a condition not mentioned in this guideline, contact the product Technical Service Department prior to starting the project. For steel surfaces, refer to Guideline Instructions for Surface Preparation of Structural Steel, Form G-2. Repair of surface irregularities including bugholes, spalls, cracks, deteriorated joints, slopes, areas near transition zones, such as around drains, floor boxes, doorways, etc. must be repaired prior to the placement of the flooring system and/or the system must be designed to off-set the thickness of the irregularities.

G. ADDITIONAL SURFACE PREPARATION REFERENCES

1. Important and relevant information on surface preparation of concrete is available by referencing the following codes, standards, and guidelines.
 - a. SSPC The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pa. 15222-4643, (412) 281-2331.
 - 1) SSPC-SP 13 Surface Preparation of Concrete
 - 2) SSPC-TU 2/NACE 6G197 Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment
 - b. ICRI International Concrete Repair Institute, 38800 Country Club Drive Farmington Hills, MI 48331, (248) 848-3809
 - c. Technical Guideline No.03732, "Selecting and Specifying Concrete Surface"
 - 1) Preparation for Sealers, Coatings, and Polymer Overlays". Includes visual standards to act as a guide in defining acceptable surface profiles for the application of industrial coatings and polymer floor toppings.
 - 2) Technical Guideline No.03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion".
 - d. ASTM American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, (610) 832-9585
 - 1) ASTM D 4258 "Practice for Surface Cleaning Concrete for Coating"
 - 2) ASTM D 4260 "Standard Practice for Acid Etching Concrete"
 - 3) ASTM D 4261 "Practice for Surface Cleaning Unit Masonry for Coating"
 - 4) ASTM D 4262 "Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces"
- The performance of elastomeric products, requires a relatively uniform dry film thickness to resist drying shrinkage and thermal movement of the concrete, while maintaining a seamless bridge or seal over the concrete. Therefore it is critical that all mortar splatter, protrusions, ridges, penetrations, or

sharp projections in the surface of the concrete, be ground smooth or otherwise made smooth, in addition to the normal surface preparation outlined above.

2.02 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 3. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Specified remediation, if required.
 - 5. Patching, smoothing, and leveling, as required.
 - 6. Other preparation specified.
 - 7. Adhesive bond and compatibility test.
 - 8. Protection.

2.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Test in accordance with ASTM F1869 and as follows.
- C. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- E. Report: Report the information required by the test method.

2.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Test in accordance with ASTM F2170 Procedure A and as follows.
- C. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- E. Report: Report the information required by the test method.

2.05 ALKALINITY TESTING

- A. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- B. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- C. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

2.06 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

END OF SECTION

**SECTION 092116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal furring materials.
- C. Metal ceiling framing.
- D. Cementitious backing board.
- E. Gypsum wallboard.
- F. Mold-Resistant Gypsum Wallboard
- G. Impact-Resistant Wallboard
- H. Joint treatment and accessories.
- I. Metal framing for overhead braced urinal screen post.

1.02 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. 06 2000 - Finish Carpentry
- D. Section 072100 - Thermal Insulation:
- E. Section 078400 - Firestopping
- F. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- G. Section 093000 - Tiling:

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- E. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2026).
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
- I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

- L. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.
- M. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets; 2023.
- N. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- Q. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- R. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- S. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2025.
- T. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
- U. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- E. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Refer to wall type plans for wall types.
- C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics: Refer to Life Safety Plans
 - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
 - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
 - 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC; ____: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries; ____: www.jaimesind.com/#sle.

3. Marino; ____: www.marinoware.com/#sle.
 4. Phillips Manufacturing Company; ____: www.phillipsmfg.com.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
1. Studs: "C" shaped with flat or formed webs with knurled faces.
 2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
 4. Ceiling Joist:
 5. Furring: Hat-shaped sections, minimum depth as required for UL Listing and Authority having Jurisdiction.
 6. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through both legs; both legs expanded metal mesh.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
- E. Gypsum Board Ceiling Suspension System: Steel grid system of main tees and support bars connected to structure using hanging wire.
1. Products:
 - a. Equal to USG Corporation; Drywall Suspension System: www.usg.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company; ____: www.americangypsum.com/#sle.
 2. CertainTeed Corporation; ____: www.certainteed.com/#sle.
 3. Continental Building Products; ____: www.continental-bp.com/#sle.
 4. Georgia-Pacific Gypsum; ____: www.gpgypsum.com/#sle.
 5. National Gypsum Company; ____: www.nationalgypsum.com/#sle.
 6. USG Corporation; ____: www.usg.com/#sle.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut. Type X - 5/8 inch thick
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 3. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
 - b. CertainTeed Corporation; Type X Drywall.
 - c. Continental Building Products; Firecheck Type X.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - e. Substitutions: See Section 016000 - Product Requirements.
 4. Mold Resistant Paper Faced Products: Type X - 5/8 inch; **For use behind fiberglass reinforced paneling.**
 - a. American Gypsum Company; M-Bloc Type X.
 - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
 - c. Continental Building Products; Mold Defense Type X.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.

- e. Substitutions: See Section 016000 - Product Requirements.
- C. Backing Board For Tiled Areas:
 - 1. Application: Surfaces behind areas where hard tile is specified on metal stud framing. Refer to finish schedule. **Exterior applications as noted in Wall Sections and Enlarged Exterior Details.**
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch (___ mm).
 - 4. Installation instructions for exterior applications:
 - a. Predrill holes through cement board and into CMU wall to a depth of 1/2 inches longer than the screw.
 - b. Install 2-1/4 inch long x 3/16 inch diameter concrete screw equal to Rodenhouse Grip Deck with Rodenhouse Grip-Plate Lath and Plaster washer and tighten screw/washer flush with the surface of the cement board.
 - c. Achieve at least 1-1/4 inch screw embedment into CMU.
 - d. Screw spacing as recommended by cement board manufacturer.
 - e. Provide alkali-resistant fiberglass mesh tape at cement board joints as recommended by manufacturer. Coordinate product and installation with Fluid Applied Air Barrier Manufacturer.

2.04 ACCESSORIES

- A. Acoustic Insulation: Preformed glass fiber, friction fit type, unfaced. Provide at all interior gypsum board/metal stud partitions to the full width of the partition and to the full height of the partition. Refer to section 07 2100 Thermal Insulation.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 - 1. Rigid Corner Beads: Low profile, for 90 degree outside corners.
 - 2. Architectural Reveal Beads:
 - a. Shapes: As indicated on drawings.
 - 3. Expansion Joints: V-shaped PVC with tear away fins
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Powder-type vinyl-based joint compound.
 - 5. Chemical hardening type compound.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members at ___ inches on center (at ___ mm on center).
 - 1. Level ceiling system to a tolerance of 1/600.
 - 2. Laterally brace entire suspension system.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing as indicated and as required to accommodate metal joist above finished ceiling. .
 - 2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
 - 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
 - 4. Joist: Size and space as required to accommodate hanging of acoustical tile, lighting and other electrical elements, and mechanical registers and elements. Bear and fasten on metal stud partitions.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
 - 1. Orientation: Horizontal.
 - 2. Spacing: As indicated.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- G. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.
- H. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall mounted door hardware.
 - 7. Refer to Section 06 1000 - Rough Carpentry for additional requirements.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Cementitious Backing Board: Install over steel framing members where indicated and at all locations of wall tile at metal stud framing, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
- H. Gypsum board shall not touch the floor, provide 1/2" clearance.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
- C. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

**SECTION 093000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for tiled wall and floor applications.
 - 1. **Refer to Drawings.**
- B. Backer Boards as tile substrate, refer to Section 09 2116 Gypsum Board Assemblies.
- C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 09 0561 Common Work Results from Flooring Prep
- B. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 092116 - Gypsum Board Assemblies: Tile backer board.
- D. Section 224000 - Plumbing Fixtures

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- D. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- E. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- G. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- H. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
- I. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- J. ANSI A108/A118/A136.1 - Specifications for the Installation of Ceramic Tile; 2020.
- K. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2023.
- L. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).
- M. ASTM C1027-99 Abrasion Resistance Data to equal Class Four or Class Five
- N. ASTM C1028-06 Static Coefficient of Friction (COF) Slip Resistance of tile
- O. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- P. ASTM C648-04 Breaking strength
- Q. ASTM C650-04 Chemical Resistance

- R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2026.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. The Tiling contractor shall present for approval of architect all approved submittals of materials and demonstrate all installation methods specified.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, and color arrangement.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up of each tile type where indicated on drawings, incorporating all components specified for the location; and all installation methods.
1. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

- A. Refer to finish schedule for tile types, colors, basis of design manufacturers, and products. Prior to beginning work provide the architect a written statement that are equal, by the same manufacturer and are all compatible for a durable and long-lasting tile installation.
1. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.

1. Applications: Edge Strips and Thresholds: [Extruded Aluminum], color as selected by Architect. Equal to Schluter, straight and radiused as required. Conform to ADAAG Requirements. Verify all tile and stone thickness in selection of trim.
 - a. Wall outside corners, to edge of tile wainscoting: Equal to Schluter Rondec. Provide termination components.
 - b. Refer to drawings.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Provide solid surface ADA Compliant threshold equal to Corian.

2.03 SETTING MATERIALS

- A. Manufacturers:
1. ARDEX Engineered Cements; _____: www.ardexamericas.com.
 2. Bostik Inc; _____: www.bostik-us.com/#sle.
 3. Custom Building Products; _____: www.custombuildingproducts.com.
 4. LATICRETE International, Inc; 4-XLT polymer fortified thin set mortar, ANSI A118.4, A118.15, A118.11, ISO 13007-1 C2T: www.laticrete.com/sle. **(Basis of Design)**
 5. Merkrete, by Parex USA, Inc; _____: www.merkrete.com/#sle.
 6. ProSpec, an Oldcastle brand; _____: www.prospec.com.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
1. **Provide thick set mortar bed as shown on drawings equal to Laticrete 226 with 3701 admixture.**

2.04 GROUTS

- A. Manufacturers:
1. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout - Premium Epoxy Grout: ANSI A118.3, **Basis of Design (or approved equal)**, www.laticrete.com/#sle. specs
 2. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12 and TCNA F125.
1. Thickness: _____ mils (_____ mm), maximum.
 2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.
 3. Products:
 - a. LATICRETE International, Inc: www.laticrete.com/#sle. Liquid crack suppression with reinforcing fabric.
 - b. Provide crack suppression membrane on concrete floor substrates to receive tile per manufacturer's recommendations prior to tile installation.
 - c. **Waterproofing for all tiled floors and all shower walls with reinforcing fabric equal to Laticrete 9235. Install per manufacturer's recommendations. At adjacent tiled walls not at showers, turn waterproofing 6" minimum up walls.**
- B. Waterproofing Membrane: equal to **Laticrete 9275** -. Other products must be approved in writing by Architect per Substitution Procedures Section 01 2500.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with polymer fortified adhesive mortar manufacturer's requirements, with epoxy grout, unless otherwise indicated. Provide waterproofing /crack suppression membrane at all tiled floor locations and up all adjacent tiled walls 6" high.

3.05 INSTALLATION - WALL TILE - THIN SET METHODS

- A. Over cementitious backer units on metal studs, install in accordance per TCNA (HB) Method. Provide polymer fortified adhesive thin set mortar and epoxy grout on cementitious board over metal studs. Refer to shower walls for other grouting requirements. Provide waterproof membrane at **all tiled shower walls, at all tiled floors.**

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

**SECTION 095100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 053100 - Steel Decking: Placement of special anchors or inserts for suspension system.
- B. Section 072100 - Thermal Insulation: Acoustical insulation.
- C. Section 211300 - Fire-Suppression Sprinkler Systems: **Sprinkler heads in ceiling system.**
- D. Section 265100 - Interior Lighting: Light fixtures in ceiling system.
- E. Section 284600 - Fire Detection and Alarm: Fire alarm components in ceiling system.
- F. Applicable sections from Divisions 21, 23, & 26.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
- E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS - SEE FINISH SCHEDULE

A. Acoustical Panel Ceilings (**ACT-1**)

1. Surface Texture: Smooth Texture
2. Composition: Mineral fiber
3. Color: See finish schedule.
4. Size: 24 in x 24 in
5. Edge Profile: Square Tegular
6. Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton: 0.85
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton: 35
8. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton: 170
9. Flame Spread: ASTM E 1264; Class A
10. Light Reflectance (LR) White Panel: ASTM E 1477; 0.85
11. Dimensional Stability: HumiGuard Plus
12. Recycle Content: Up to 76% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)
13. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
14. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
15. Indoor Air Quality Certified to SCS-105 v.4.2-2023
16. Basis of Design: **CALLA**, as manufactured by Armstrong World Industries, Inc.

B. Acoustical Panel Ceilings (**ACT-2**)

1. Surface Texture: Smooth Texture
2. Composition: Mineral Fiber
3. Perforation: Unperforated
4. Color: See finish schedule.
5. Size: 24 in x 24 in
6. Edge Profile: Square Lay-In
7. Ceiling Attenuation Class (CAC) : ASTM E1414/E1414M; Classified with UL label on product carton: 40
8. Flame Spread: ASTM E1264; Class A
9. Light Reflectance (LR) White Panel: ASTM E 1477; 0.80
10. Dimensional Stability: Standard
11. Recycle Content: Up to 41% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)
12. Indoor Air Quality Certified to SCS-105 v4.2-2023
13. Basis of Design: **Clean Room VL**, as manufactured by Armstrong World Industries, Inc.

2.02 SUSPENSION SYSTEM(S)

- A. Suspension Systems - Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Exposed Steel Suspension System Type 1: Formed steel, commercial quality cold rolled; heavy-duty.
 - a. Profile: Tee; 15/16 inch (24 mm) wide face.
 - b. Finish: White painted.
 - c. Product: Equal to Armstong Prelude XL 15/16" or Donn DXL 15/16"
 - d. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

2.03 ACCESSORIES

- A. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid Type I: Provide L-shaped molding for mounting at same elevation as face of grid.
- B. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, ASTM E 580/E 580M, ASTM C 636/C 636M, and ASTM E 580/E 580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
 2. Miter corners.
- K. Coordinate with mechanical, plumbing and electrical.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 1. Cut to fit irregular grid and perimeter edge trim.
 2. Make field cut edges of same profile as factory edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 095426
WOOD VENEER CEILING PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Perforated / Non-Perforated Wood Veneer tegular lay-in ceiling panels.
- B. Accessories for ceiling installation.
- C. Deposits for materials may be required.

1.02 SUBMITTALS

- A. Product Data: Manufacturer's technical data sheet and installation instructions for each type of ceiling panel required.
- B. Shop Drawings: **Submit shop drawings, including details for all ceilings, to Architect for approval.** Coordinate ceiling layout, installation, and suspension system components with construction elements that penetrate panel ceilings, are supported by, or are above ceiling. Show overall layout with dimensions and details for penetrations and intersections with other materials or building components.
- C. Samples: Submit three (3) full size samples of each panel type and veneer type required.
- D. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.
- E. Test Reports: Upon request, submit certified test reports from recognized test laboratories.
 - 1. MAINTENANCE MATERIAL
- F. Extra Materials:
 - 1. If extra materials are required, amount, type, color and pattern of material to be determined by the installer.
 - 2. Extra materials shall be from the same production run as the original materials.
 - 3. Extra materials shall remain in the manufacturer's original packaging and given to the building owner upon substantial completion of the work. Store extra materials per instructions as described in storage and handling requirements.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturers: Provide wood ceiling panels from a single manufacturer.
 - 2. Installers: Utilize an installer having demonstrated experience on projects of comparable size and complexity.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements:
 - 1. Follow manufacturer's delivery and receiving instructions.
- B. Storage and Handling Requirements:
 - 1. Handle products carefully to avoid damage or chipping edges.
 - 2. Store products in a clean, cool, dry place, and out of direct sunlight.
 - 3. Store products in a space where the ambient temperature and humidity conditions are being maintained at the levels indicated for the project when occupied for its intended use.

1.05 SITE CONDITIONS

- A. Ambient Conditions:
 - 1. Permit panels to reach room temperature, 50 to 86 degrees Fahrenheit. Stabilize moisture content, 25 to 55 percent RH, for at least 72 hours before installation per AWI standards
 - 2. Maintain ambient temperature and humidity conditions at levels indicated for the project when occupied for its intended use.
 - 3. Do not install products under environmental conditions outside manufacturer's recommended limits.

- B. Existing Conditions: Do not install wood ceiling panels until space is enclosed and weather proofed, wet work is completely dry, and work above ceilings is complete.

1.06 WARRANTY

- A. Provide manufacturer's written product warranty per Section 01 7833 – Special Project Warranties.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: ASI Architectural, 123 Columbia Court N, Chaska, MN 55318. Phone: 888-258-4637. Fax: 952-448-2613. Website: www.asiarchitectural.com
- B. Approved Equals:
1. 9Wood, (888) 767-9990
 2. Armstrong World Industries, (850) 433-8321

2.02 DESCRIPTION

- A. Product Description: **Fusion Wood Tegular Lay-in ceiling panels** as manufactured by ASI Architectural.
- B. Product Options: For each item listed below, please select one (1) option from the choices.
1. Panel Composition: Wood veneer
 2. Core: Class A FR MDF Board
 3. Edge Banding: To match veneer species and finish
 4. Finish: Clear lacquer topcoat
 5. Veneer Species: Maple
 6. Perforations: Perforated / Unperforated - **See drawings for specific requirements.**
 7. Perforation Pattern when applicable: Diamond
 8. Perforation Size when applicable: 4mm
 9. Perforation Spacing when applicable: 16mm
 10. Panel thickness: 3/4"
 11. Size: 24" x 48"
 12. Grid Size: 9/16"
 - a. Suspension System: Square tegular lay-in, 9/16", Type 2 - **Refer to Section 09 5100 Acoustical Tile Ceilings**
 - b. Wood Veneer Panel Ceiling Manufacturer has the option of providing the ceiling grid as specified in 09 5100.
 - c. The installer of grid shall be the same installer as the panels.
- C. ACCESSORIES
1. Attachment hardware for ceiling panels as specified by manufacturer for installation.
 2. If perforated, SoundTex acoustic nonwoven porous sound-absorbing material applied to back of panel.
 3. Accessories with Options: Select one (1) option from the choices for each of the following accessories.
 - a. Where perforated, acoustical backer: (1") / (2") x 24" x 48". Black.
 - b. Vertical trim: 3/4" x (4") / (6") / (Custom) x (96") / (120"). Vertical trim finish to match finish of ceiling panels.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
1. Inspect installation area and conditions under which work is to be performed for compliance with all manufacturers' environmental requirements.
 2. All wet work in the installation area must be complete, cured, and dry prior to installation.

3. Work above ceilings shall be complete, inspected, and accepted before ceiling work begins.

3.02 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of ceiling panels and industry standards.
- B. Coordinate the exact size, location, and sequencing of penetrations of ceiling panels by all building components.
- C. Lay out ceiling pattern per approved shop drawings if required. Where not otherwise indicated, lay out panels so margins on opposite sides of rooms are equal or greater than half (1/2) the panel width.

3.03 ADJUSTING

- A. Adjust panels after installation so that surfaces are aligned, flush, and level with gaps between units consistent in width and straight.

3.04 CLEANING

- A. Clean surfaces of ceiling panels per manufacturer's instructions.
- B. Remove and replace damaged or discolored material and material that cannot be properly cleaned.
 1. PROTECTION
- C. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the owner.

END OF SECTION

SECTION 096460
WOOD ATHLETIC AND SPORTS FLOORING

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Scope
 - 1. The complete installation of Wood Athletic Sports Flooring System in the Gymnasium.
- B. Related work specified under other sections. (A cross-reference should be incorporated in these sections.)
 - 1. Common Work Results for Flooring Repairation - Section 09 0561
 - 2. Thresholds - Transition between new wood gym floor and existing adjacent flooring.
 - 3. Game Standard Inserts - Job Verify

1.02 REFERENCES

- A. MFMA - Maple Flooring Manufacturers Association
- B. MFMA PUR – Performance Uniformity Requirements
- C. DIN 108032 (part 2) 2001 - Performance Test
- D. DIN 108032 (part 2) 1991 - Performance Test
- E. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems
- F. EN 14904 – European Committee for Standardization – Surfaces for Sports areas
- G. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems
- H. FIBA – International Basketball Federation
- I. FSC – Forest Stewardship Council

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications
 - 1. Basis of design: Bio-Channel SB floor system as provided by Robbins Sports Surfaces, www.robbsfloor.com, (800-543-1913); products accepted as equal, provided ALL system materials and performance criteria are met:
 - a. Connor Sports – Focus
 - b. Action Flooring – ActionTech (plywood)
 - 2. Manufacturer shall be an established firm experienced in products specified in this section and have been in the sports flooring business a minimum of ten (10) years, Robbins, Inc. or an approved equal.
 - 3. Manufacturer shall be a member in good standing of the Maple Flooring Manufacturers Association (MFMA) for a minimum of five (5) consecutive years.
 - 4. Materials other than those listed must be approved ten (10) days prior by written addendum. Materials from non-approved manufacturers will not be accepted.
- B. Floor Contractor/Installer Qualifications and Certifications
 - 1. The flooring contractor shall be a Robbins Accredited Installation Company with MFMA Accredited Installer(s) on-site for the duration of the wood floor installation; or a contractor approved by Robbins Sports Surfaces.
 - 2. Flooring contractor shall submit a list of at least five completed projects of similar magnitude and complexity completed under current corporate identity.
- C. Floor System Performance Requirements
 - 1. Bio-Channel SB meets or exceeds the following performance criteria:
 - a. MFMA PUR
 - b. DIN 18032 Part2 2001
 - c. DIN 18032 Part2 1991
 - d. ASTM F2772 Sport Floor Standards
 - e. FIBA International Standards

- f. EN 14904 Standards
- 2. Independent testing report showing the system passing all criteria shall be provided as part of the bid qualification process and submittal process.
- 3. Surface Appearance
 - a. Expansion spaces will not exceed 1/64" (0.4mm) at time of installation and will be spread evenly across the floor with each row of flooring.
 - b. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).
- 4. The wood flooring shall be MFMA-FJ maple, MFMA-RL will not be accepted.
- 5. Maple Flooring shall be tested in accordance with California Department of Public Health/EHLB/Standard Method Version 1.2, 2017 and been found to be in compliance with the standard.
- 6. PVC, urethane, granular rubber in binder, or closed-cell foam pads will not be accepted as resilient pads.

1.04 SUBMITTALS

- A. Specification
 - 1. Submit Robbins Bio-Channel SB specification sheet or approved equal..
- B. Drawing
 - 1. Submit Robbins Bio-Channel SB drawings or approved equal. .
- C. Sample
 - 1. Submit one (1) sample of Bio-Channel SB.
 - 2. Samples of color and stain samples of finishes, lines, and graphics.
- D. Concrete Guidelines
 - 1. Submit Robbins Technical Services "Concrete Guide Specification" for further information regarding conditions and requirements of concrete prior to installation.
- E. Maintenance Guidelines
 - 1. Submit copy of Maintenance Instructions.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials
 - 1. Materials shall not be delivered, stored, or installed until all masonry, painting, plastering tilework, marble and terrazzo work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit (13 to 27 degrees Celsius) and relative humidity of 35-50 % are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied
 - 2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

1.06 JOB CONDITIONS-SEQUENCY

- A. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.
- B. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit (13 to 27 degrees Celsius) and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.
- C. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or owner requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by owner (or owner's agent) of complete gymnasium floor.

1.07 WARRANTY

- A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of the other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.
- B. Robbins, Inc. hereby warrants the Bio-Channel SB material to be free from manufacturing defects for a period of 1 year. This warranty is in lieu of all other warranties, expressed or implied including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligations on the part of Robbins. In the event of breach of any warranty, the liability of Robbins shall be limited to repairing or replacing Bio-Channel SB material and system components supplied by Robbins and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Vapor Barrier
 - 1. 6-mil polyethylene.
- B. Subfloor
 - 1. 9/16" Zero/G™ Lineal Strip shock pad; PVC, urethane, granular rubber in binder, or closed-cell foam pads will not be accepted.
 - 2. Bio-Channel SB Subfloor panels that have been factory prepared to accept lineal strips. Plywood only, OSB or HPS subfloor panels will not be accepted.
- C. Maple Flooring Manufacturers Association (MFMA) Wood Flooring:
 - 1. 25/32" (20mm) thick x 2 1/2" (64mm) face width with 2 1/4" (57mm) mill option as acceptable, 2nd and Better grade, Factory Sanded Advantage XL with non-sanded option as acceptable, TGEM, KD Northern Hard Maple, Continuous Strip XL Plus Flooring as manufactured by Robbins and graded in accordance with MFMA-FJ rules. Flooring will have XLplus technology to reduce or eliminate routine spacing for expansion.
- D. Fasteners
 - 1. Flooring 1 3/4" (44mm) barbed cleats or staples.
- E. Finishing materials
 - 1. MFMA approved sealer
 - 2. MFMA approved finish
- F. Game lines
 - 1. Game line paint(s) shall be recommended by the finishing materials manufacturer and must be compatible with the finish.
 - 2. Refer to drawings for guide lines on Gym Lines and graphics.
 - a. Submit finish samples, color samples and graphic layout for logo. Owner to provide contractor with digital graphic of logo information.
- G. Perimeter
 - 1. 3" x 4" ventilating type. Provide black or brown as selected by architect.
- H. Coordinate with existing volley ball hardware. Relocate and refasten as required for new floor.

PART 3-EXECUTION

3.01 INSPECTION

- A. Inspect concrete slab for proper tolerance and dryness and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8" (3mm) in a 10' (3m). Refer to Section 09 0561 Common Work Results for Flooring Preparation. Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.
- B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.

- C. Subfloor shall be broom cleaned by general contractor.
- D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.02 INSTALLATION

A. VAPOR BARRIER

- B. Install polyethylene with joints lapped a minimum of 6" (150mm) and turned up 4" (100mm) at the walls.

C. SUBFLOOR

- 1. Install Robbins shock absorbing pad per manufacturer's recommendations to plywood sheets.
- 2. Following manufacturer's guidelines, place Bio-Channel Star subfloor assembly in end-to-end manner, staggering end joints in adjacent rows. Allow for a ¼" (6mm) gap between panels. Panels shall be placed on a 45-degree angle to the direction of the maple flooring. Provide 1-½" to 2" (40 to 50mm) expansion void at the perimeter and all vertical obstructions.
- 3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
- 4. Install Bleacher Blocking per manufacturer's recommendations.

D. FLOORING

- 1. Machine nail maple finish flooring 10" to 12" (150mm to 200mm) O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Consult your local Robbins Accredited Installation Company "Certified" contractor. Provide 2" (50mm) expansion voids at the perimeter and at all vertical obstructions. Expansion rows will be evenly distributed with each row of flooring, with each space not exceeding 1/64" (0.4mm).

3.03 FINISHING

A. SANDING

- 1. Sand per manufacturer's recommendations.
- 2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
- 3. Inspect entire area of floor to ensure the floor presents a smooth surface without drum stop marks, gouges, streaks, or shiners.
- 4. Vacuum and/or tack floor before first coat of seal.

B. FINISHING

- 1. Floor should be clean and completely free of dirt and sanding dust.
- 2. Apply specified combination of seal, game line paint, and finish in accordance with manufacturer's instructions.
- 3. Buff and vacuum and/or tack between each coat after it dries.
- 4. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Game lines shall be painted between seal coats and finish coats. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.

3.04 WALL BASE INSTALLATION

- A. Install vent cove base anchored to walls with base cement or screws. Use pre-molded outside corners and neatly mitered inside corner.

3.05 CLEANING

- A. Clean up all unused materials and debris and remove it from the premises.

3.06 MAINTENANCE

- A. Upon completion of floor installation, the owners, attendants, or individuals in charge are responsible for the upkeep of the building and are to see that the care and maintenance instructions of the MFMA and Robbins are followed.

END OF SECTION

**SECTION 096513
RESILIENT FLOORING ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- C. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019 (Reapproved 2025).
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2013b.
- E. ASTM F137 - Standard Test Method for Flexibility of Resilient Flooring; 2011
- F. ASTM F1514 - Standard Test Method for Measuring Heat Stability for Color Change; 2003 (Reapproved 2008)
- G. ASTM F1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change; 2003 (Reapproved 2008)
- H. ASTM F1914 - Standard Test Method for Short-Term Indentation and Residual Indentation of Resilient Floor Covering; 2007 (Reapproved 2011)
- I. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate seaming plans and floor patterns.
- C. Verification Samples: Submit two samples, 12 by 12 inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports. See Specification 09 0561.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Materials/ Attic Stock: Quantity equivalent to 3 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures as recommended by the manufacturer but not less than 65 degrees or more than 85 degrees.
- B. Maintain the ambient relative humidity between 40-60% during installation.

PART 2 PRODUCTS

2.01 RESILIENT BASE - SEE FINISH SCHEDULE

- A. Traditional Rubber Resilient Base, see **RB-1** on Finish Schedule: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - c. Roppe Corp: www.roppe.com/#sle.
 - d. Mannington Burkebase, www.manningtoncommercial.com/#sle. **Basis of Design.**
 - 2. Length: Roll.
 - 3. Color: See finish schedule.
 - 4. Accessories: Premolded external corners.
 - 5. Style: Cove (with top-set toe).
 - 6. Height: See finish schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive manufacturer.
- C. **Flooring manufacturers to give architect written approval that substrate is acceptable prior to commencing with any floor installation. This shall not add any cost to the owner or time to the contract schedule.**
- D. Refer to paragraph 1.03 References for floor substrate testing.
- E. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with patching or underlayment compound recommended by the resilient flooring manufacturer and for job conditions for filling or smoothing, or both. The flooring contractor shall include these cost in their bid.
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

3.03 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.04 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.05 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. No heavy traffic, rolling loads or furniture for 72 hours after installation.

END OF SECTION

**SECTION 096519
RESILIENT TILE FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Installation accessories:
 - 1. Adhesives.
 - 2. Finishes and cleaners.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: SCS FloorScore certification documentation.
- B. Section 03 3000 Cast in Place Concrete
- C. Section 07 9005 - Joint Sealants.
- D. Section 09 0561 Common Work Results from Flooring Prep.

1.03 REFERENCE STANDARDS

- A. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2025.
- B. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, with Editorial Revision.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. ASTM F1514 - Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change; 2003 (Reapproved 2013).
- E. ASTM F1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change; 2003 (Reapproved 2008).
- F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- G. ASTM F1914 - Standard Test Method for Short-Term Indentation and Residual Indentation of Resilient Floor Covering; 2007 (Reapproved 2011).
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's documentation for flooring and accessories:
 - 1. Technical Data.
 - 2. Installation and Maintenance.
 - 3. Warranty.
- C. Verification Samples: Submit two samples, 6 by 30 inch (____ by ____ mm) in size illustrating color and pattern for each resilient flooring product specified.
- D. Verification Samples: Submit two samples, full size, illustrating color and pattern for each resilient flooring product specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and that the material is of the correct style, color, quantity and run number(s).

- B. Store all materials flat and off of the floor in an acclimatized, weather-tight space between 65 to 85 degrees F (18 to 29 degrees C).
- C. Do not double stack pallets.

1.06 FIELD CONDITIONS

- A. Acclimate material at jobsite between 65 to 85 degrees F (18 to 29 degrees C) and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.
- B. Spread unopened cartons no more than 6 cartons high and at least 4 inches (101 mm) apart.
- C. Keep away from heating and cooling ducts and direct sunlight.
- D. If permanent HVAC is not operational, temporary means should be used to maintain the recommended temperature and relative humidity levels.
- E. Close areas to traffic during installation of flooring and accessories.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Should only be installed by professional flooring mechanics that have demonstrated successful installations of jobs in similar size and scope.

1.08 WARRANTY

- A. Manufacturer's 15-Year Limited Commercial Warranty for Luxury Vinyl Flooring

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Luxury Vinyl Tile
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 RESILIENT TILE FLOORING

- A. Luxury Vinyl Flooring: **LVT-1 (Basis of Design)** - Refer to finish schedule.
 - 1. Equal to: Mannington Commercial - Spacia, Wood
 - 2. Color: See finish schedule.
 - 3. Size: See finish schedule.
 - 4. Physical Properties:
 - a. Product Construction: Non-ortho Phthalate
 - b. Wear Layer Thickness: 20 mil (0.51 mm)
 - c. Total Thickness: 0.098" (2.5 mm)
 - d. Wear Layer: Quantum Guard Elite
 - 5. Manufacturing, Performance, and Safety Standards:
 - a. Static Load (ASTM F970): Passes
 - b. Resistance to Heat (ASTM F1514): Passes
 - c. Resistance to Light (ASTM F1515):
 - d. Resistance to Chemicals (ASTM F925): Passes
 - e. Smoke Density (ASTM E662, Flaming Mode): Passes
 - f. Radiant Panel (ASTM E648) Passes, Class 1

2.03 ACCESSORIES

- A. Moldings, Transition and Edge Strips: See dwgs for transtion details.
- B. Adhesive and Adhesive Encapsulators: As recommended by flooring manufacturer.
- C. Finishes and Cleaners: As recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION _____

- A. Install flooring and accessories after other operations (including painting) have been completed.
- B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
 - 1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.
- C. Verify that substrate is contaminant-free, including old adhesives and any chemicals.
- D. Test substrates as required by manufacturer to verify proper conditions exist.
 - 1. Concrete:
 - a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
 - b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
 - c. Perform alkalinity testing to verify pH level is between 5 to 9 per ASTM F710.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prior to installation, the flooring installer should plan and attend an on-site construction meeting with the General Contractor, Architect and Property Owner to review all requirements and inspect site conditions as outlined in the manufacturer's installation document, as well as to review the requirements of ASTM F710 and any relevant building codes, or local, state, or national regulations.
- B. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
- C. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank and Tile Flooring.
 - 2. Concrete Substrates: Prepare substrate per ASTM F710.
 - a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
 - b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
 - 1) Do not use solvents or adhesive removers.
 - c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.
 - d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.
 - 1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.
 - 2) Sand smooth per manufacturer's instructions.
 - e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
 - f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.
 - g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank Underlayment compound shall

be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M prior to installation of underlayment provide architect written approval by flooring manufacturer citing all specified warranties will be in affect.

- h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.
- 3. Existing and Other Substrates:
 - a. Refer to manufacturer's professional installation guide and/or contact manufacturer, as special conditions may exist.

3.03 INSTALLATION

- A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Layout shall be specified by Architect, Designer or End User.
 - 2. Follow layout and ensure installation reference lines are square.
 - 3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
 - 4. Check cartons for and do not mix dye lots.
 - 5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
 - a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
 - b. Install movement joint systems per manufacturer's instructions.
 - 6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
 - a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
 - b. Periodically spot-check transfer of adhesive to back of tile during installation.
 - c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
 - d. Protect floor from traffic per manufacturer's instructions.
 - e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 FIELD QUALITY CONTROL

- A. Site tests and inspections per Section 01 4000 and as follows:
 - 1. Inspect flooring installation for non-conforming work including (but not limited to) the following:
 - a. Lack of adhesion.
 - b. Bubbles, loose tiles or raised edges.
 - c. Dirt and debris underneath flooring.
 - d. Excessive gaps.
 - e. Improper substrate preparation (as indicated by telegraphing).
 - f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.
- B. Non-conforming work per General Conditions and as follows:
 - 1. Repair or replace damaged material if not acceptable to the Architect.

3.05 CLEANING

- A. Waste Management per Section 01 7000 and as follows:
 - 1. Coordinate material reclamation program with manufacturer, if applicable.
 - a. Store and return cartons and pallets to manufacturer or recycler for reuse or recycling.
- B. Provide progress cleaning per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.
 - a. Clean and protect completed construction until Date of Substantial Completion.

- b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.
- 2. Site: Maintain project site free of waste materials and debris.
- C. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 01 7000 and 01 7800
 - 1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.
 - 2. Clean floor with a neutral 6-8 pH cleaner or as recommended by manufacturer.

3.06 MAINTENANCE

- A. Initial maintenance per flooring manufacturer's written instructions.

3.07 PROTECTION

- A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
 - 1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
 - 2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
 - 3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
 - 4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

**SECTION 098430
SOUND-ABSORBING WALL AND CEILING UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical wall panels

1.02 RELATED REQUIREMENTS

- A. Section 095100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout.
- D. Selection Samples: Manufacturer's color chart indicating full range of colors and patterns available.
- E. Verification Samples: Fabricated samples of each type of panel specified, minimum 6" x 6"
- F. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.06 WARRANTY

- A. Shapes: One (1) year from date of substantial completion
- B. Suspension System: Ten (10) years from date of substantial completion

PART 2 PRODUCTS

2.01 SOUND-ABSORBING UNITS

- A. General:
 - 1. Prefinished, factory assembled acoustical panels.
 - 2. Surface Burning Characteristics: Class A as follows, tested per ASTM E84 and CAN/ULC S102:
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
- B. **ACOUSTICAL PANEL (AP-1) SEE FINISH SCHEDULE.**
 - 1. Surface Texture: Fine
 - 2. Composition: Fiberglass
 - 3. Color: See finish schedule.
 - 4. Shape Design: See finish schedule.
 - 5. Edge Profile: Square
 - 6. Acoustics: Sound absorption up to 1.00 Noise Reduction Coefficient (NRC) ASTM C 423

7. Flame Spread: ASTM E 1264; Class A (UL)
 8. Basis of Design: **Soundscape Shapes**, as manufactured by Armstrong World Industries
- C. Mounting Accessories
1. Item 5455 – Drywall Hanging Kit (2 per kit) For individual panel attachment to structure.
 2. Item 5588 – Wall Hanging Kit (4 per kit) For individual panel attachment to a wall.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with shop drawings.
- C. Replace damaged and broken shapes.

3.03 CLEANING

- A. Contractor shall remove and dispose of shipping containers and debris.
- B. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

**SECTION 099113
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Plastic trim fabrications.
 - 7. Wood Exterior Systems.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
 - 2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 3. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.
 - 4. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Label each coat of each Sample.
 - 3. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Indicate VOC content.

1.04 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location 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.

1.05 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: [1 gal. (3.8 L)] of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 1 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); including the following or approved equal as applicable.
 - 1. Tnemec: www.tnemec.com
 - 2. Behr Process Corporation: www.behr.com
 - 3. PPG Architectural Finishes, Inc: www.ppgaf.com
 - 4. Benjamin Moore & Co: www.benjaminmoore.com
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
 2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.
- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: For field applications, provide paints and coatings that complies with VOC content limits of authorities having jurisdiction.
- C. Colors: As selected by Architect from manufacturer's full range.

2.03 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Fiber-Cement Board: 12 percent.
 - c. Masonry (Clay and CMU): 12 percent.
 - d. Wood: 15 percent.
 - e. Portland Cement Plaster: 12 percent.
 - f. Gypsum Board: 12 percent.
 2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
 3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 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. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer[.] [but not less than the following:]
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. 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.
- H. 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.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Interior Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Exterior Wood Substrates (Semi-Transparent):
 - 1. Must be clean and dry. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth. Patching compounds will generally be visible through clear coatings.
- L. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 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. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.

3.04 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.

3.05 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.

3.06 EXTERIOR PAINTING SCHEDULE

- A. Concrete, Clay Masonry, Portland Cement Plaster (Stucco), Cementitious Siding, Non-traffic Surfaces:
1. Prime Coat: SW Loxon Concrete & Masonry Primer Sealer, LX02W50, at 8.0 mils (0.203 mm) wet, 3.2 mils (0.081 mm) dry.
 2. Intermediate Coat: Matching topcoat.

3. Topcoat: SuperPaint Exterior Acrylic Latex Satin, A89 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
- B. Concrete Substrates - Semi-Transparent Stain and Sealer, Non-traffic Surfaces:
 1. Acceptable products or approved equal:
 - a. H&C COLORTOP Solvent-Based Solid Color Concrete Sealer
- C. CMU Substrates:
 1. Block Filler: SW Pro Industrial Heavy Duty Block Filler, B42W150, at 75 to 100 sq. ft. per gal. (1.84 to 3.07 sq. m per liter).
 2. Intermediate Coat: Latex, exterior, matching topcoat.
 3. Topcoat: SW SuperPaint Exterior Latex Satin, A89 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
- D. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
 1. Prime Coat: SW Pro-Cryl Universal Primer- B66W1310
 2. Intermediate Coat: Same as topcoat.
 3. Topcoat : SW Pro-Industrial Acrylic - B66-650 Series
- E. Ferrous Metal Substrates, Primed:
 1. Prime Coat: SW Pro-Cryl Universal Primer- B66W1310
 2. Intermediate Coat: Same as topcoat.
 3. Topcoat : SW Pro-Industrial Acrylic - B66-650 Series
- F. Wood Substrates: **Provide if noted on drawings.**
 1. Prime Coat: SW Extreme Bond Primer, B51, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.
 2. Intermediate Coat: Latex, exterior, matching topcoat.
 3. Topcoat: SW SuperPaint Exterior Latex Satin, A89 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
- G. Plastic Trim Fabrication Substrates: Including architectural PVC, plastic, and fiberglass items. **Provide if noted on drawings.**
 1. Prime Coat: SW ProBlock Premium Water-Based Primer, B51-620 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry.
 2. Intermediate Coat: Latex, exterior, matching topcoat.
 3. Topcoat: SuperPaint Exterior Latex Gloss, A84 Series, at 4.0 mils (0.102 mm) wet, 1.3 mils (0.033 mm) dry, per coat.

END OF SECTION

**SECTION 099123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Cast iron.
 - 5. Galvanized metal.
 - 6. Wood (Opaque and Transparent Finish).
 - 7. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
 - 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 3. Section 099313 "Exterior Stains and Transparent Finishes"
 - 4. Section 099323 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - 5. Section 099600 "High-Performance Coatings".

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Label each coat of each Sample.
 - 3. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Indicate VOC content.

1.04 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location 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.

1.05 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: 1 gal. (3.8 L) of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 1 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of the following:
 - 1. Tnemec: www.tnemec.com
 - 2. Behr Process Corporation: www.behr.com
 - 3. PPG Architectural Finishes, Inc: www.ppgaf.com
 - 4. Benjamin Moore & Co: www.benjaminmoore.com
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:
 - 1. Products are approved by manufacturer in writing for application specified.
 - 2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.
- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

- A. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall provide materials that comply with VOC limits of authorities having jurisdiction and for interior paints and coatings applied at Project site, the following VOC limits exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 5. Floor Coatings: 100 g/L.
 6. Shellacs, Clear: 730 g/L.
 7. Shellacs, Pigmented: 550 g/L.
- C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."
- D. Colors: As selected by Architect from manufacturer's full range

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
 - e. Plaster: 12 percent.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 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. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- E. 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.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- G. 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.
- H. 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.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.03 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.

3.04 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.

3.05 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.

3.06 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Pedestrian Traffic Surfaces:
 - 1. Urethane Coating:
 - a. First Coat:
 - 1) SW Armorseal, Rextthane I B65C60: Smooth; Color: Clear.
 - b. Second Coat:
 - 1) SW Armorseal, Rextthane I B65C60: Smooth; Color: Clear.
 - c. If necessary, provide additional coats in accordance with Manufacturer's requirements for five (5) year warranty.
- B. Metal Substrates (Aluminum, Steel, Galvanized Steel):
 - 1. Latex System (Steel Columns, Metal Fabrications, Metal Doors and Frames):
 - a. Prime Coat: Primer, rust-inhibitive, water based:
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils (0.127 to 0.254 mm) wet, 2.0 to 4.0 mils (0.051 to 0.102 mm) dry.
 - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based acrylic, semi-gloss:
 - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.
 - 2. Water-Based Dry-Fall System (Overhead Steel Structure, Metal Deck, Exposed Fire Protection, Plumbing, Mechanical and Electrical Components):
 - a. Top Coat: Dry-fall latex, flat:
 - 1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-W2181 Series, at 6.0 mils (0.152 mm) wet, 1.5 mils (0.038 mm) dry.
- C. Wood opaque finished substrates: Including exposed wood items not indicated to receive shop-applied finish.
 - 1. Wood Substrates, Transparent Finish: Stained, polyurethane coating: two (2) finish coats over stain coat and sanding sealer.
 - a. Stain Coat:
 - 1) Sherwin-Williams; Minwax Performance Series Stain, tintable stain.

- b. Intermediate Coat:
 - 1) Sherwin-Williams; Same as finish coat.
 - c. Finish Coat:
 - 1) Sherwin-Williams; Minwax Performance Series Polyurethane Varnish Satin
- D. Gypsum Board Substrates:
- 1. Walls - Latex System:
 - a. Prime Coat: Primer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W12600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell:
 - 1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series, at 4.0 mils (0.102 mm) wet, 1.7 mils (0.043 mm) dry, per coat.
 - 2. Ceilings - Latex System:
 - a. Prime Coat: Primer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W12600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat:
 - 1) S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series, at 4.0 mils (0.102 mm) wet, 1.7 mils (0.043 mm) dry, per coat.

END OF SECTION

**SECTION 099601
HIGH-PERFORMANCE COATINGS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Exterior Exposed Structural Steel
 - b. Interior Exposed Structural Steel
 - c. Galvanized Metal Decking (Shop Primed)
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 05 3100 "Steel Decking"
 - 3. Section 09 9123 "Exterior Painting" for special-use coatings and general field painting.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (203.2 mm) square.
 - 2. Label each coat of each Sample.
 - 3. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.04 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location 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.

1.05 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: 1 gal. (3.8 L) of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).

- b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Material Performance Criteria:
 1. Products: Provide certified test reports when submitting products other than those specified herein the specification. Test reports shall indicate the test method, system and requirements for those products being submitted, and shall meet or exceed the test criteria and performance values of the specified coatings herein.
- C. Applicator Qualifications:
 1. Preparation and Workmanship: A firm or individual with a minimum of (5) years' experience in applying coatings similar in material design, whose work has resulted in applications with a record of successful in-service performance.
- D. Warranty:
 1. Provide manufacturers 15 Year warranty, starting from the date of substantial completion. Provide sample warranty with product submittals and samples.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to project site in undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.
 6. Surface preparation requirements.
 7. Application instructions.
- B. 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 (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 1 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product for steel/metal substrates:

1. Tnemec Company, Inc.; www.tnemec.com
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:
 1. Products are approved by manufacturer in writing for application specified.
 2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.
- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
 1. Provide materials for use within each coating 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 coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC content limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 5. Floor Coatings: 100 g/L.
 6. Shellacs, Clear: 730 g/L.
 7. Shellacs, Pigmented: 550 g/L.
- C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Service's "Standard Practice for the Testing of Volatile Organic Chemical Emissions from Various Sources Using Small Scale Environmental Chambers."
- D. Colors: As selected by Architect from manufacturer's full range.

2.03 PRODUCTS

- A. Organic Zinc Rich Primer:
 1. Tnemec Series 90-97 Tneme-Zinc
 - a. Generic Type: Organic Zinc Rich Urethane Primer
 - b. Zinc Content: 83% by weight. ASTM D520 Type III Zinc Dust
 - c. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.
 - d. Adhesion: ASTM 4541 Elcometer Adhesion.
 - e. Humidity: ASTM D 4585. 4,000 hours exposure.
 - f. Immersion: ASTM D 870 Potable Water Immersion. 7 years immersion.
 - g. Prohesion: ASTM G 85 Prohesion Cabinet. 15,000 hours exposure.
 - h. Slip Coefficient: Meets the requirements of a Class B surface.
- B. Polyamide Epoxy:
 1. Tnemec Series 66 Hi-Build Epoxoline
 - a. Generic Type: Polyamide Epoxy
 - b. Solids By Volume: 56%.

- c. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe and blistering).
 - d. Immersion: ASTM D 870. 7 Years.
 - e. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
 - f. Adhesion: ASTM 4541 Elcometer Adhesion.
 - g. Humidity: ASTM D 4585. 4,500 hours.
- C. Fluoropolymer:
 - 1. Tnemec Series 1070 Fluoronar
 - a. Generic Type: Thermoset Fluoropolymer Polyurethane
 - b. Solids By Volume: 60%.
 - c. Salt Spray (Fog): ASTM B 117, 10,000 hours exposure
 - d. Adhesion: ASTM 4541 Elcometer Adhesion.
 - e. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
 - f. Flexibility: ASTM D 522 (Method A)
 - g. Hardness: ASTM 3363.
 - h. Humidity: ASTM 4585, 3,000 hours exposure
 - i. Impact: ASTM B2794
 - j. QUV: ASTM D 4587, 25,000 hours exposure.
 - k. Exterior Exposure: ASTM D 41 41, Method C (EMMAQUA), 5,000 MJ/m² Exposure. Report gloss retention and color retention.
 - l. AAMA 2605 (10 Years South Florida Exposure)
- D. Self-Crosslinking Acrylic
 - 1. Tnemec Series 115 Uni-Bond
 - a. Generic Type: Self-Corsslinking Hydrophobic Acrylic
 - b. Solids by Volume: 44%
 - c. Abrasion: ASTM D 4060
 - d. Adhesion: ASTM D 4541, (Method E – Type V Tester)
 - e. Humidity: ASTM D 4585, 2,000 hours exposure
 - f. Light Reflectance: ASTM E 1477
 - g. Salt Spray: ASTM B 117, 500 hours exposure

2.04 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if the two coatings are incompatible.

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report in writing conditions that may affect application, appearance, or performance of paint.

- B. Substrate Conditions:
 - 1. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
 - 2. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.
 - 3. Do not begin installation until substrates have been properly prepared.
 - 4. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification 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.
- C. Clean substrates of substances that could impair bond of coatings, 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 coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
 - 2. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
 - 3. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 - 5. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
- 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.

3.03 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with manufacturer's instructions.
- B. Fabrication Defects:
 - 1. Correct steel and fabrication defects revealed by surface preparation.
 - 2. Remove weld spatter and slag.
 - 3. Round sharp edges and corners of welds to a smooth contour.
 - 4. Smooth weld undercuts and recesses.
 - 5. Grind down porous welds to pinhole-free metal.
 - 6. Remove weld flux from surface.
- C. Ensure surfaces are dry.
- D. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.
- E. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- F. Coordination of shop-applied prime coats is critical.
 - 1. Remove incompatible primers and re-prime substrate with compatible primer as required to produce coating systems indicated.

3.04 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.
- E. Apply high-performance coating to all exterior structural steel framing.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where installed on or in association with exterior structural steel framing and/or exposed to view: Metal piping, plastic piping, pipe hangers and supports, metal conduit, plastic conduit, duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

3.05 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.06 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.
- E. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.07 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Exterior Exposed Structural Steel: Color as selected by Architect.
 - 1. Shop Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning with a minimum angular profile of 1.5 mils 0 inch (0.04 mm)

2. Field Surface Preparation: SSPC SP 11 Power Tool Cleaning to Bare Metal any areas with visible rust. Must be clean, dry and free of dust, dirt, oil, grease and other contaminants.
 3. Primer: Tnemec Series 90-97 Tname-Zinc at 2.5 to 3.5 mils (0.0889 mm) DFT.
 4. Spot Primer: Tnemec Series 90-97 Tname Zinc at 2.5 to 3.5 mils (0.0889 mm) DFT. Spot prime any areas damaged or areas with visible rust.
 5. Stripe Coat (all weld seems and sharp edges): Tnemec Series 66 HI-Build Epoxoline at 3.0 – 4.0 mils (0.1016 mm) DFT
 6. Intermediate Coat: Tnemec Series 66 HI-Build Epoxoline at 3.0 – 4.0 mils (0.1016 mm) DFT
 7. Second Intermediate Coat: Tnemec Series 66 HI-Build Epoxoline at 3.0 – 4.0 mils (0.1016 mm) DFT
 8. Finish Coat: Series 1070 Fluoronar at 2.0 – 3.0 mils (0.0762 mm) DFT. Use Series 1070 (Gloss), Series 1071 (Semi-Gloss), or Series 1072 (Satin)
 9. Total Dry Film Thickness: 10.5 to 14.5 mils (0.3683 mm)
- B. Interior Exposed Structural Steel: Color as selected by Architect.
1. Shop Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning with a minimum angular profile of 1.5 mils (0.0381 mm).
 2. Field Surface Preparation: SSPC SP 11 Power Tool Cleaning to Bare Metal any areas with visible rust. Must be clean, dry and free of dust, dirt, oil, grease and other contaminants.
 3. Primer: Tnemec Series 90-97 Tname-Zinc at 2.5 to 3.5 mils (0.0889 mm) DFT.
 4. Spot Primer: Tnemec Series 90-97 Tname Zinc at 2.5 to 3.5 mils (0.0889 mm) DFT. Spot prime any areas damaged or areas with visible rust.
 5. Finish Coats: Apply two (2) coats of Series 115 Uni-Bond at 2.0 – 4.0 mils (0.1016 mm) DFT
- C. Galvanized Acoustical Decking (Shop Primed): Color as selected by Architect.
1. Surface Preparation: Clean all visible rust using SSPC-SP3 Power Tool Cleaning (interior dry) or to bare metal using SSPC-SP11 Power Tool Cleaning to Bare Metal (weather exposed). (Test patch is recommended in accordance with Technical Bulletin 98-10R latest revision.) Must be clean, dry and free of dust, dirt, oil, grease and other contaminants.
 2. Spot Primer: Tnemec Series 66 Hi-Build Epoxoline
 3. Finish Coats: Apply two (2) coats of Series 115 Uni-Bond at 2.0 – 4.0 mils (0.1016 mm) DFT

END OF SECTION

**SECTION 101423
SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel Signage
- B. Dimensional Letters
- C. Environmental Graphics

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A475 - Standard Specification for Metallic-Coated Steel Wire Strand; 2022.
- C. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.
- D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 879 - Electric Sign Components; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
 - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.

- B. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

1.07 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's 5 year warranty against fading, defects in materials, and workmanship. Letters shall be guaranteed for the life of the business against defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panel Signage:
 - 1. Best Sign Systems, Inc: www.bestsigns.com
 - 2. Knight Sign Industries, Inc.: www.knightsign.com
 - 3. FASTSIGNS International, Inc: www.fastsigns.com
 - 4. Takeform: www.takeform.net
 - 5. Inpro Corporation: www.inprocorp.com
 - 6. Substitutions: See Section 016000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 PANEL SIGNAGE

- A. Panel Signage:
 - 1. Application: Room and door, interior directional and information signs. Refer to Drawings for additional information and requirements.
 - 2. Description: Flat signs with applied character panel media, tactile characters.
 - 3. Sign Size: As indicated on drawings.
 - 4. Color and Font: As indicated on drawings.
 - 5. Material: As indicated on drawings.
 - 6. Tactile Letters: Raised 1/32 inch (0.79 mm) minimum.
 - 7. Braille: Grade II, ADA-compliant.
 - 8. Sign Height: Varies, for multiline text or signage with pictograms. ADA-compliant.

2.04 DIMENSIONAL LETTERS

- A. Dimensional Letters
 - 1. Application: Exterior dimensional letters, building identification. Refer to Drawings for additional information and requirements.
 - 2. Description: Painted dimensional letters.
 - 3. Sign Size: As indicated on drawings.
 - 4. Color and Font: As indicated on drawings.
 - 5. Materials: As indicated on drawings.
 - 6. Fabrication: As indicated on drawings.

2.05 ENVIRONMENTAL GRAPHICS

- A. Environmental Graphic
 - 1. Description: Flat vinyl graphics.
 - 2. Vinyl fabric wallcoverings shall meet FS CCC-W-408A and CFFA-W-101 quality standards.
 - 3. Vinyl wallcoverings shall contain mildew inhibitors.

4. Wall Covering Materials:
 - a. Subject to compliance with requirements, provide one of the following:
 - 1) Royson HD Walls Vinyl fabric wallcovering, 20 oz, Matte finish or equal.
 - 2) Royson HD Walls PVC-free vinyl coated wallcovering, 5.3 oz min, Nolar smooth finish or equal.
5. Digital Printing:
 - a. Digital Printing Process: 12-color high-def printing process using UV stable inks, as appropriate for each substrate.
 - 1) Resolution: 150 dpi/pixels minimum print resolution at actual finished size.
 - 2) Digital printed images shall be prepared from electronic files reproduced by the signage vendor based on files provided by the Architect or Owner. Original art shall be defined as artwork that is a first-generation reproduction of the specified art.
 - 3) Final installed images shall be consistent and continuous, with no unintended variation in color or pattern. Edges shall be trimmed smooth and true.
6. Color: As indicated on drawings.

2.06 ACCESSORIES

- A. Multiple mounting methods are described below. Refer to drawings for mounting method(s) required within the project.
- B. Cable Display Systems: Sizes and configurations indicated on drawings.
 1. Manufacturers:
 - a. Arakawa Hanging Systems: www.arakawagrip.com/#sle.
 - b. AS Hanging Display Systems, Inc: www.ashanging.com/#sle.
 - c. Nova Display Systems, Inc: www.novadisplay.com/#sle.
 - d. Substitutions: See Section 01 6000-Product Requirements.
 2. Description:
 - a. Tensioned cable display system used to support shelving, panels, and artwork from walls and ceilings with the following components:
 - 1) Wire Cable: 7x7 construction.
 - (a) Stainless Steel: ASTM A555/A555M; ASTM A666/A666M, Type 304 or Type 316.
 - (b) Size: 1/16-inch (1.5 mm) diameter.
 - (c) Cable End: Loop-End fitting.
 - 2) Cable Gripper Fittings: Provide stainless steel fittings as indicated on drawings.
- C. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, or other based on best recommended for the applicable substrate.
- D. Exposed Screws: Chrome plated.
- E. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Refer to drawings and Part 2 of this specification section for mounting methods required by the project scope.
- B. Install in accordance with manufacturer's instructions.
- C. Install with horizontal edges level.

- D. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- E. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 102113.19
SOLID PLASTIC TOILET PARTITIONS

PART 1 GENERAL

0.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Solid plastic urinal screens.

0.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Concealed steel support members.
- B. Section 05 5000 - Metal Fabrications: Concealed steel support members.
- C. Section 06 1000 - Rough Carpentry: Blocking and supports.
- D. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

0.03 ABBREVIATIONS AND ACRONYMS

- A. HDPE: High-density polyethylene.

0.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2021.
- E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2025.
- F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- J. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

0.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work with placement of support framing and anchors in walls and ceilings.

0.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on panel construction.
- C. Shop Drawings:
 - 1. Indicate plans, elevations, and dimensions. Include door swings on plans.
 - 2. Indicate details of wall, floor, and ceiling supports and attachments.

3. Indicate reflected ceiling plan view of and ceiling grid at overhead support locations.
4. Indicate cutouts for through-partition toilet accessories.
- D. Samples:
 1. For Initial Selection: Submit color charts.
 2. For Verification: Submit two samples of partition materials, 3 inches by 3 inches (76 mm by 76 mm) in size, indicating color.
- E. Sustainable Design Documentation:
 1. Product Data: For recycled content, indicate postconsumer and preconsumer recycled content and cost.
- F. Manufacturer's qualification statement.

0.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

0.08 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver, store, and handle materials and products in accordance with manufacturer's instructions and recommendations and industry standards.
- C. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at minimum of 60 degrees Fahrenheit (15.56 degrees Celsius).
- D. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.
- E. Lay cartons flat, with adequate support to ensure flatness and prevent damage to prefinished surfaces.
- F. Do not store where ambient temperature exceeds 120 degrees Fahrenheit (48.89 degrees Celsius).

0.09 FIELD CONDITIONS

- A. Ambient Conditions: Maintain environmental conditions such as temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Ambient Conditions: Maintain building temperature at minimum of 60 degrees Fahrenheit (15.56 degrees Celsius) for 24 hours before, during, and after installation of toilet partitions.
- C. Existing Conditions: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

0.10 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 25-year manufacturer warranty for HDPE material against breakage, corrosion, and delamination.

PART 2 PRODUCTS

1.01 MANUFACTURERS

- A. **Basis of Design** Manufacturer: Bobrick - www.bobrick.com/#sle.
- B. Other Acceptable Manufacturers:
 1. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
 2. Scranton Products Hiny Hiders..

3. Products by listed manufacturers are subject to compliance with specified requirements found in specification and in Technical Data Sheet of selected ASI model and prior approval of Architect.
- C. Substitutions: See Section 016000 - Product Requirements.
 1. Submit proposed substitutions in writing for approval by Architect minimum of 10 working days prior to bid date and make available to bidders. Accompany proposed substitutes with review of specification and the appropriate ASI Group partition company specifications noting compliance on line-by-line basis.
 2. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, Contractor accepts responsibility for costs associated with necessary modifications to related work, including design fees.
- D. Source Limitations: Furnish products produced by single manufacturer.

1.02 PLASTIC TOILET COMPARTMENTS

- A. Toilet Compartments: Solid plastic (HDPE), standard privacy, floor anchored, overhead braced.
- B. Urinal Screens: Solid plastic (HDPE), ceiling-hung pilaster.
- C. Design Criteria:
 1. Accessibility: Design compartments indicated on drawings to comply with ICC A117.1 and ADA Standards.
 2. **Fire Performance: Provide assemblies that pass when tested in accordance with NFPA 286.**
 3. **Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less (Class B), when tested in accordance with ASTM E84.**
- D. Fabrication:
 1. Fabricate toilet compartment components to sizes indicated.
 2. Coordinate requirements and provide cutouts for through-partition toilet accessories.
 3. Provide shoes and caps at pilasters and posts to conceal anchorage, supports, and leveling mechanisms.
 - a. Provide Easy-Stall shoes at floor anchored, overhead braced toilet compartments.
 4. Provide manufacturer's standard corrosion-resistant supports, leveling mechanisms, anchors, and anchoring assemblies for pilasters and posts.
 5. Floor-Anchored, Overhead-Braced Units: Provide supports, leveling mechanisms, Easy-Stall shoes, and anchors at pilasters to suit floor conditions.
 6. Urinal and Entrance Screen Posts: Provide anchoring assemblies with leveling adjustment at tops of posts.

1.03 COMPONENTS

- A. Doors and Panels: Single sheets of solid molded homogenous high-density polyethylene (HDPE).
 1. Finish:
 - a. Color: As selected from manufacturer's color card.
 - b. Texture: Manufacturer's standard for selected color.
 2. Edges: 1/4-inch 0.24 inch (6 mm) radius machined edges.
 3. **Heat Sink: Extruded aluminum attached to bottom of doors and panels.**
 4. Sightline-Free Component
- B. Door and Panel Dimensions:
 1. Thickness: 1 inch (25.4 mm).
 2. Door Width: 24 inches (609.6 mm)[_____] inches ([_____] mm)].
 3. Door Width for Handicapped Use: [36 inches (915 mm)]_____ inches (_____ mm)], outswinging.

4. Door Panel Height: 55 inches (1397 mm).
 5. Door Height Above Floor: 14 inches (355.6 mm).
 6. Panel Depth: As indicated on drawings.
 7. Urinal/Entrance Screen Panel Height: 55 inches (1397 mm).
 8. Urinal/Screen Screen Panel Height Above Floor: 14 inches (355.6 mm).
- C. Pilasters: 1 inch (25.4 mm) thick, of sizes required to suit compartment width and spacing; minimum 3 inches (76.2 mm)[] inches ([] mm)] wide.
1. Pilaster Height: 82 inches (2082.8 mm).
 2. Easy-Stall Pilaster Shoes: Formed 20 gauge, 0.0359 inch (0.91 mm) ASTM A666 Type 304 stainless steel with No.4 finish, 3 inches (76.2 mm) high, concealing floor fastenings and leveling bolts; secured to pilaster with stainless steel tamper-resistant screws; secured to floor with concrete anchors.
 - a. Provide height and leveling adjustment with machine thread leveling bolts and bottom of pilaster threaded inserts.
 - b. Provide Easy-Stall shoes at floor anchored, overhead braced toilet compartments.
- D. Urinal Screen Post: Manufacturer's standard post design of square aluminum tube with satin finish 1-3/4 by 1-3/4 inches (44 mm), with shoe matching that on pilaster.
- E. Head Rails: Hollow anodized aluminum tube, 1- by 1-5/8-inch (25 by 1.61 inch (41 mm) size, with anti-grip surface and cast-socket wall brackets.

1.04 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper[,]alloy,[]temper[.]
- C. High-Density Polyethylene (HDPE):
1. Composition: Formed from waterproof, nonabsorbent, high-density polyethylene resins.
 2. Properties: Mark-resistant self-lubricating surface.
 3. Fire Resistance: ASTM E84, Class B.
 4. Material Fire Ratings: NFPA 286, Pass.
 5. Material Fire Ratings: ICC (IBC), Class B.
- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, Type 304, stretcher-leveled standard of flatness.
- E. Stainless Steel Castings: ASTM A743/A743M.
- F. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome-plated.

1.05 HARDWARE AND ACCESSORIES

- A. Brackets:
1. Continuous Type: Clear anodized aluminum, standard depth.
- B. Door Hardware: Brushed stainless steel:
1. Hinges: Brushed stainless steel continuous hinge, cam type, swings to closed or partially open position.
 2. Latch and Keeper: Chrome Plated Brushed Zamac Occupancy Indicator Slide Latch.
 3. Coat Hook: Manufacturer's standard coat hook with rubber bumper; one per compartment, mounted on door.
 4. Door Pull: Provide door pull for outswinging doors. Provide on both sides of doors designated as accessible.
 5. Door Bumper: Provide rubber-tipped door bumpers at out-swinging doors.
- C. Attachments, Screws, and Bolts: Stainless steel , tamper-resistant type.
1. For Attaching Panels and Pilasters to Brackets: Sex-type through-bolts and nuts , tamper-resistant.
- D. Toilet Partition Suspension Members: See Section 055000 .

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

2.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Attach Easy Stall shoe system to floor with 1/4 by 2 inch (6 by 52 mm) screws. Insert pilaster into Easy Stall shoe and secure after height adjustment.
- C. Maintain maximum 1/2-inch (0.51 inch (13 mm)) []-inch ([] mm) space between pilasters and panels.
- D. Maintain maximum 1-inch (0.98 inch (25 mm)) []-inch ([] mm) space between wall and panels.
- E. Attach panel brackets securely to walls using anchor devices.
- F. Attach panels and pilasters to brackets. Locate head rail joints at pilaster centerlines.
- G. Do not permit field touch-up of scratches or damaged finish. Replace damaged or scratched materials with new materials.

2.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6.35 mm) [] inch ([] mm).
- B. Maximum Variation From Plumb: 1/8 inch (3.18 mm) [] inch ([] mm).

2.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (4.76 mm).
- B. Adjust hinges to locate doors in partially opened position when unlatched. Return outswinging doors to closed condition.
- C. Adjust adjacent components for consistency of line or plane.

2.05 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION

**SECTION 102226
OPERABLE PARTITIONS**

PART 1 - GENERA

1.01 WORK INCLUDED

- A. Individual Panel, Operable Wall System

1.02 RELATED WORK

- A. Structural Support: Structural support system required for suspending the operable wall shall be designed, installed, and pre-punched in accordance with ASTM E 557 and manufacturer's shop drawings.
- B. Insulation: Sound insulation and baffles for the plenum area above the track system, under the permanent floor, inside air ducts passing over or around the operable wall, and in permanent walls adjoining the operable wall system shall be in accordance with ASTM E 557.
- C. Opening Preparation: Proper and complete preparation of the operable wall system opening shall be in accordance with ASTM E 557, and shall include floor leveling; plumbness of adjoining permanent walls; substrate and/or ceiling tile enclosures for the track system; and the painting and finishing of trim and other materials adjoining the head and jamb areas of the operable wall. Any permanent wall(s) receiving an adjustable or fixed wall jamb will require internal structural blocking to secure the jamb to the permanent wall. Refer to manufacturer's shop drawings for additional details.

1.03 SYSTEM DESCRIPTION

- A. The operable wall system shall consist of Individual Panels that are top supported by two (2) multi-directional carriers that are capable of negotiating 90o "X", "L" and "T" intersections.
- B. The operable wall system shall consist of acoustically rated panels tested in accordance with ASTM E 90 and ASTM E 413 test procedures, and shall have achieved a STC rating as specified herein.

1.04 QUALITY ASSURANCE

- A. The operable wall shall have been tested in an independent acoustical testing laboratory in accordance with ASTM E 90 and ASTM E 413 test procedures.
- B. The operable wall panel construction and finish materials shall consist of Class A-rated materials in accordance with ASTM E 84.
- C. The operable wall shall be installed by the manufacturer's authorized distributor in accordance with ASTM E 557.

1.05 REFERENCES

- A. ASTM E 90: Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- B. ASTM E 413: Determination of Sound Transmission Class (STC).
- C. ASTM E 557: Architectural Application and Installation of Operable Partitions.
- D. ASTM E 84: Surface Burning Characteristics of Building Materials.
- E. ASTM A 653: Specification for General Requirements for Steel Sheet, Alloy-Coated (Galvannealed) by the Hot Dip Process.
- F. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- G. CCC-W-408A: Federal Specification which applies to Vinyl Coated Wall Coverings.
- H. CFFA-W-101-D: Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wall Coverings.

1.06 SUBMITTALS

- A. Manufacturer shall provide written technical information and related detail drawings, which demonstrate that the products comply with contract documents for each type of operable partition specified.
- B. Manufacturer shall provide detailed engineering drawings featuring track plan, panel elevation, horizontal and vertical details, and beam punching template as required.
- C. Manufacturer shall provide a written test report of the independent acoustical testing laboratory certifying the attainment of the specified STC rating, upon request.
- D. Manufacturer shall provide written instructions specifying the proper operation and maintenance of the operable wall system.
- E. Manufacturer shall provide a color selector demonstrating the manufacturer's selections of the specified finish material.
- F. Samples shall consist of actual swatches of the specified finish material.
- G. DELIVERY, STORAGE, AND HANDLING
 - 1. Panels shall be individually wrapped in a protective plastic covering to keep panels clean during delivery, storage, and handling.
 - 2. Panels shall be stored on edge and above the floor on cushioned blocking in a dry and ventilated area, protected from humidity and temperature extremes.

1.07 SEQUENCING / SCHEDULING

- A. Beam Punching: Manufacturer shall provide beam punching template drawing detailing the anchor locations for the suspended track system (as required for Drop Rod Mounting), as required for the fabrication and installation of structural overhead support by others.
- B. Track Installation: Scheduling of operable wall track installation shall occur after structural overhead support has been properly and completely fabricated and installed by others.
- C. Panel Installation: Operable wall panel installation shall occur after fixed wall substrate construction is properly and completely installed by others, as required to protect panels from ongoing adjacent construction.

1.08 WARRANTY

- 1. Manufacturer shall warrant each operable wall panel and its component parts to be free from defects in material and workmanship for a period of ten (10) years from the date of Substantial Completion.
- 2. Manufacturer also warrants the fixed top seals, track, carriers, and its component parts to be free from defects in material and workmanship for a period of ten (10) years from the date of Substantial Completion.

PART 2 – PRODUCT SPECIFICATIONS

2.01 BASIS OF DESIGN

- A. Basis of Design; Kwik-Wall Company.
 - 1. Series 2000, Model 2020 Individual Panels / Multi-Directional
- B. Substitutions; Refer to Section 01 2500 Substitution Procedures

2.02 PANEL CONSTRUCTION

- A. Panel Dimensions: Standard panel dimension shall be a nominal 3" {76} thick.
- B. Panel Frame: Vertical steel frame members shall be minimum 18-gauge galvanized steel, horizontal top cross member shall be minimum 12-gauge galvanized steel, which meets or exceeds ASTM A 653 requirements. Frame shall be all-welded construction with steel corner supports and cross-bracing reinforcements. Panel frame shall be Class A-rated fire-retardant, non-combustible, and non-corrosive in accordance with ASTM E 84.
- C. Panel Facing: Panel facing shall be Class A-rated in accordance with ASTM E 84. Panel facing material shall consist of:
 - 1. Vinyl Coated Fabric

2. Color and type as selected and approved by Owner and Architect.
- D. Panel Hinges (if required): Panel hinges shall be architectural grade, full-leaf butt hinges. Hinges shall be attached to the steel frame of the panel, and reinforced with a steel backer plate.
- E. Panel Weight: Maximum panel weight shall be 6.5 – 9.2 lb./ ft.2 (32 – 45 kg/m2) depending on STC rating, size and options selected.

2.03 OPERATION

- A. Operation shall be Individual Panels with a Multi-Directional track system that allows the panels to negotiate 90o “X”, “L” and “T” intersections as required for movement of panels from storage location(s) to various installed positions. Panels shall be top-supported by two (2) carriers featuring dual horizontal precision bearings with high-strength polymer tires riding on a structural aluminum track.

2.04 STACK ARRANGEMENTS

- A. Stack Type:
 1. Perpendicular Stack: consisting of panels stacked perpendicular to the wall's installed position.
- B. Stack Quantity: Panels shall be stored as indicated in the drawings.

2.05 FINISHES

- A. Finish Material Type: Panel finish material shall be Class A rated in accordance with ASTM E 84:
 1. Vinyl: consisting of Type II, reinforced vinyl weighing 21 oz./lin. yd. (651 g/lin. m). Vinyl shall meet or exceed CCC-W-408A and CFFA-W-101-D quality standards.
 2. Color and Type as selected and approved by Owner and Architect
- B. Finish Material Supplier:
 1. Factory Supplied: from manufacturer's standard selection of finish materials

2.06 PERIMETER TRIM AND SEALS

- A. Vertical Trim and Seals: Panels shall have vertical astragals containing flexible vinyl seals and incorporate reversible tongue-and-groove-type configurations for positive interlocking with adjacent panels.
- B. Horizontal Top Trim and Seals: Top seals shall consist of flexible vinyl sweep seals installed on both sides of the panel. The seals shall consist of a compressed bulb between two (2) fingers of vinyl.
- C. Horizontal Bottom Trim and Seals: Bottom seals shall consist of multiple fingers of flexible vinyl for positive contact and sealing with various floor surfaces.
- D. Horizontal and Vertical Panel Trim: All exposed panel trim and hinges shall be of one (1) similar color, as selected from manufacturer's standard colors.

2.07 CLOSURE SYSTEMS

- A. Initial Closure System: The lead panel (the first panel exiting the stack) shall form a seal vertically against a rigid wall surface, as accomplished by:
 1. Adjustable Starter Jamb: consisting of an aluminum extrusion which is permanently mounted to a structural wall surface and is field-adjustable to compensate for out-of-plumb conditions of the fixed wall. The Adjustable Starter Jamb shall incorporate a tongue-and-groove-type vertical astragal for positive interlocking with the lead panel.
- B. Final Closure System: The final closure panel (the last panel exiting the stack) shall form a seal vertically against a rigid wall surface.

2.08 ACOUSTICAL PERFORMANCE

- A. Certification: The operable wall shall have been tested in an independent acoustical testing laboratory in accordance with ASTM E 90 and ASTM E 413 test procedures.

- B. STC Rating: 42 minimum.

2.09 PANEL ACCESSORIES

- A. Accessories shall be compatible with other accessories and options, furnished and installed by the operable wall manufacturer as noted on submitted shop drawings.
 - 1. Dry Marker Writing Surfaces
 - 2. Recessed Eraser Trays

2.10 TRACK SYSTEMS

- A. Track Type: The operable wall track system shall be extruded from structural aluminum alloy, which prohibits deterioration caused by rust or corrosion. Aluminum track shall have a durable, clear, satin anodized finish that resists color fading and flaking. The track shall utilize grooves and interlocking steel pins for positive alignment of adjacent track sections. The track joints shall be reinforced overhead by a heavy-duty steel bracket made of hot-rolled, 3/8" 10 thick plate steel.
- B. Aluminum track shall include an integral nut slot to accept a hardened steel square nut for attachment of each steel all-rod and splice brackets to the overhead structural support.

2.11 CARRIER SYSTEMS

- A. Carrier Type: Each individual panel shall be top supported by two (2) carriers utilizing a 5/8" [16] diameter pendant bolt. Each carrier shall consist of dual horizontal, permanently lubricated, precision-ground steel bearings with high-strength polymer tires as required for smooth and quiet operation. Multi-Directional carriers shall be capable of negotiating 90o "X", "L" and "T" intersections as required for moving panels from storage location(s) to various installed positions.

2.12 SUSPENSION SYSTEMS

- A. Mounting Systems:
 - 1. Drop Rod Mount to track square nut raceway: consisting of adjustable rods of grade 2, 3/8" 10 diameter threaded steel all-rod provided with 3/8" 10 serrated steel nuts. Note: Standard rod spacing width is 2.5" on each side of the opening run centerline.
 - 2. Drop Rod Bracket Mount : consisting of 3/8" 10 thick steel brackets by 8" wide, mounted to the square nut integral raceways at the top of track, and suspended with adjustable rods of grade 2, 3/8" 10 diameter threaded steel all-thread rod provided with 3/8" 10 serrated steel flange nuts.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Proper and complete preparation of the operable wall system opening shall be by others in accordance with the architectural drawings, manufacturer's shop drawings, and ASTM E 557. Any deviation of the actual opening from these specifications shall be called to the attention of the architect prior to the installation of the operable wall.
- B. Deficiencies in the operable wall opening shall be corrected by others prior to installation of the operable wall.

3.02 INSTALLATION

- A. The operable wall system shall be installed by manufacturer's authorized distributor.
- B. The operable wall shall be installed in accordance with manufacturer's written instructions, shop drawings and ASTM E 557 installation guidelines.

3.03 ADJUSTING AND CLEANING

- A. The operable wall panels and track system shall be adjusted and cleaned in accordance with manufacturer's written instructions.

3.04 PROTECTION

- A. The operable wall panels shall be stored in the stacked (retract-ed) position prior to acceptance by the owner's representative.

3.05 DEMONSTRATION

- A. The operable wall manufacturer's authorized distributor shall demonstrate proper operation and explain proper and necessary maintenance requirements of the operable wall system to the owner's representative.

END OF SECTION

**SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Diaper changing stations.
- D. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary for Work by Owner.
- B. Section 042000 - Unit Masonry
- C. Section 06 1000 - Rough Carpentry for Concealed Wood Blocking
- D. Section 08 8300 - Mirrors: For mirrors not located in restrooms.
- E. Section 09 2116 - Gypsum Board Assemblies
- F. Section 093000 - Tiling: Wall Tile
- G. Section 10 2113 - Solid Plastic Toilet Partitions
- H. Section 224000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- C. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).
- D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- G. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Bobrick.
- B. Commercial Toilet, Shower, and Bath Accessories:

1. AJW Architectural Products; _____: www.ajw.com/#sle.
2. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
3. Bradley Corporation; _____: www.bradleycorp.com/#sle.

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. **See Toilet Accessories Schedule on drawings for basis of design.**
- B. Double Robe Hook. Equal to Bobrick B- 7672. Provide at inside face of toilet partition doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section 06 1000 for installation of blocking in walls.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.
- C. Install concealed wood blocking in wood stud framing walls prior to installing toilet accessories.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
- D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 104401
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers (Refer to Life Safety Plan for locations)
- B. Fire extinguisher cabinets (Refer to Life Safety Plan for locations)
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 09 2116 - Gypsum Board Assemblies
- D. Section 09 9123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business; []: www.ansul.com/#sle.
 - 2. Pyro-Chem, a Tyco Business; []: www.pyrochem.com/#sle.
 - 3. Amerex Corp
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Ansul, a Tyco Business; []: www.ansul.com/#sle.
 - 2. JL Industries, Inc; []: www.jlindustries.com.
 - 3. Larsen's Manufacturing Co; []: www.larsensmfg.com/#sle.
 - 4. Amerex Corp
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound (4.54 kg).
 - 3. Finish: Baked polyester powder coat Red color.
 - 4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to [] degrees F ([] degrees C).

2.03 FIRE EXTINGUISHER CABINETS

- A. Metal: Steel: Color as selected by Architect from manufacturer's colors.
- B. Cabinet Configuration: Semi-recessed type.
 - 1. Size to accommodate accessories.
- C. Door Glazing: Glass, clear, tempered, 1/8 inch (3 mm) thick float. Set in resilient channel gasket glazing.
- D. Fire Rated for one (1) hour combustable to meet UBC Standard 43-6 ASTM E-814. Trim with reinforced corners. Confirm fire rating prior to installation.

2.04 FIRE EXTINGUISHER BRACKET

- A. Provide Standard Fire Extinguisher Bracket, **if shown on drawings.**

2.05 ACCESSORIES

- A. Signage & Lettering:
 - 1. Provide signage and lettering with directional arrow and fire extinguisher icon at all fire extinguisher locations in accordance with authorities having jurisdiction (AHJ) and all applicable code.
 - 2. Fasteners: Non corrosive, as recommended by manufacturer

PART 3 EXECUTION

3.01 EXAMINATION

- A. If installed in metal stud wall provide solid wood blocking at top, bottom, and sides of cabinet locations prior to installation of cabinet
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place extinguishers in cabinets.
- C. Position cabinet signage at as directed by architect.

3.03 SCHEDULE

- A. Refer to Life Safety Plan for fire extinguisher locations.

END OF SECTION

**SECTION 105113
METAL LOCKERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. DESCRIPTION: Furnish and install Heavy-Duty Ventilated (HDV) Metal Lockers, complete, as shown and specified per the contract documents.

RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 03 3000 - Concrete
- B. Section 06 1000 - Rough Carpentry

SUBMITTALS

- A. GENERAL: Refer to Section 01 3000 ADMINISTRATIVE REQUIREMENTS - SUBMITTALS
- B. SHOP DRAWINGS: Submit drawings for Architects review showing locker types, sizes, quantities, including all necessary details relating to anchoring, trim installation and relationship to adjacent surfaces.
- C. COLOR CHARTS: Provide color charts showing manufacturer's available colors (minimum 24). Provide metal samples if requested.
- D. NUMBERING: Locker numbering sequence will be provided by the approving authority and noted on approved shop drawings returned to the locker contractor.

QUALITY ASSURANCE

- A. MANUFACTURING STANDARD: Provide metal lockers that are standard products of a single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.
- B. FABRICATOR QUALIFICATIONS: Firm experience (minimum 5 years) in successfully producing the type of metal lockers indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- C. INSTALLER QUALIFICATIONS: Engage an experienced (minimum 2 years) installer who has successfully completed installation of the type of metal lockers and extent to that indicated for this project.

PRODUCT HANDLING

- A. GENERAL: All work shall be fabricated in ample time so as to not delay construction process.
- B. DELIVERY: All materials shall be delivered to the site at such a time as required for proper coordination of the work. Materials are to be received in the manufacturer's original, unopened packages and shall bear the manufacturer's label.
- C. STORAGE: Store all materials in a dry and well ventilated place adequately protected from the elements.

WARRANTY

- A. Knock-Down Lockers are covered against all defects in materials and workmanship excluding finish, damage resulting from deliberate destruction and vandalism under this section for a period of 2 years.

PART 2 PRODUCTS

7.01 MANUFACTURERS

- A. Manufacturers are subject to compliance with the design, material, method of fabrication and installation as required in this specification section or modified as shown on drawings.
 - 1. Basis of Design: Art Metal Products - 401 Jim Moran Blvd. Deerfield Beach, FL 33442, (954) 527-8638, or equal.
 - 2. Refer to Section 01 2500 for Substitution Requirements.

LOCKER TYPES

- A. General: Lockers shall be "AMP HEAVY-DUTY VENTILATED Lockers" as manufactured by Art Metal Products or approved equal.
- B. Type: Double (2) Tier
- C. Size: 15" wide x 18" deep x 72" high
 - 1. HEAVY-DUTY VENTILATED Lockers:
 - 2. Opening Height 36"
- D. Doors: 14 gauge diamond perforated sheet steel with recessed handle, and multi-point gravity lift-type latching
- E. Sides: 16 gauge diamond perforated sheet steel.
- F. Tops, Bottoms, Shelves: 16 gauge solid sheet steel
- G. Backs: 18 gauge solid sheet steel

FABRICATION

- A. MATERIALS:
 - 1. Steel Sheet: All sheet steel used in fabrication shall be prime grade free from scale and imperfections and capable of taking a heavy coat of custom blend powder coat.
 - 2. Fasteners: Cadmium, zinc or nickel plated steel; bolt heads, slotless type; self-locking nuts or lock washers.
 - 3. Hardware: Hooks and hang rods of cadmium plated or zinc plated steel or cast aluminum.
 - 4. Handle: Seamless drawn 304 stainless steel recessed handle.
 - 5. Number Plates: To be polished aluminum with not less than 3/8" high etched numbers attached to door with two aluminum rivets.
 - a. CONSTRUCTION: Lockers shall be "AMP HEAVY-DUTY VENTILATED (HDV) Lockers as manufactured by Art Metal Products or approved equal. Fabricate lockers square, rigid and without warp, with metal faces flat and free from dents or distortion. Make all exposed metal edges safe to touch. Weld frame members together to form a rigid, one-piece structure. Weld, bolt or rivet other joints and connections as is standard with manufacturer. Grind exposed welds flush. Do not expose bolts or rivet heads on front of locker doors or frames except for fastening of number plates and recessed handle.
 - 6. FRAME: Fabricate of 16 gauge (minimum) channels, with integral continuous door stop/strike formed on both latch and hinge side vertical members. Cross frame members of 16 gauge channel shapes, including intermediate cross frame members on double and triple tier (frames with doors over 18" high) lockers shall be securely welded to the vertical framing members to ensure rigidity. Rubber bumpers shall be provided to cushion door closing.
 - 7. HAT SHELVES, INTERMEDIATE SHELVES AND BOTTOMS: Shall be formed with 16 gauge (minimum) solid sheet steel with single return bends at all sides. Bolt top and bottom as well as horizontal tier dividers of wardrobe openings to front horizontal frame members at not less than one place in addition to side panels. Form hat shelves at 60" and 72" high single tier lockers of 16 gauge (minimum) sheet steel with single bends at sides and back and a double bend at front.
 - 8. BACKS: Shall be 18 gauge (minimum) cold rolled sheet steel with double flanged connections extending full height.
 - 9. DOORS: HDV Wardrobe Doors 20" high and higher shall be fabricated from single sheet prime 14 gauge with single bends at top and bottom and double bends at the sides. The channel formed by the double bend at the latch side is designed to fully conceal the lock bar. Doors to be perforated with 5/8" x 1-1/2" diamond pattern.
 - 10. LATCHING: Shall be finger lift control type constructed of 14 gauge (minimum) steel with a nylon cover that has a generous finger pull. Spring activated nylon slide latches shall be completely enclosed in the lock channel allowing doors to close with the lock in the locked

- position. Locking device shall be designed for use with either built-in combination locks or padlocks. Provide three latch hooks for doors 48" and over and two for doors under 48".
11. HANDLES: Doors shall have a seamless drawn 304 stainless steel recessed handle shaped to receive a padlock or built-in combination lock. The recess pan shall be deep enough to have the lock be completely flush with the outer door face. A finger lift/padlock hasp shall protrude through the top of the handle for easy opening of the locker door.
 12. HDV Box Doors: Doors 18" high and under to be fabricated from single sheet prime 14 gauge with single bends at top, bottom. Doors shall include a combination friction catch door pull. Padlock Strike Plates are optional. Doors shall be fabricated to accept a built-in combination lock or padlock. Doors with projecting spring latches shall not be acceptable. Doors are to be perforated with 7/16" x 15/16" diamonds.
 13. DOOR HINGES: All doors shall include a 16 gauge continuous piano hinge welded to the door and riveted to the frame. All doors to be right hand, side hinged.

LOCKER ACCESSORIES:

- A. Double tier lockers: Openings 30" thru 36" high shall include one double prong ceiling hook and a minimum of two single prong wall hooks.
- B. Finished End Panels (where required at exposed ends): Shall be "Boxed" type formed from 16 gauge cold rolled steel with 1" O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. If lockers have slope tops, end panels must be formed with slope at top to cover the ends of the slope tops. Finished to match lockers. Provide at all exposed ends.
- C. Recessed Trim (If required): Fabricated of 16 gauge cold rolled sheet steel. 3" wide side trim shall be notched at the top and include a retainer to allow the 3" wide top trim to fit snugly into the side trim. Recess trim is designed to be used when the lockers are installed with the locker fronts flush with the top and side walls. The top and side trim will project 3/8" beyond the side and top walls and include return bends back to the walls. Finished to match lockers.
- D. Fillers (if required): Provide where indicated, of not less than 16 gauge sheet steel, factory fabricated and finished to match lockers.
 1. FINISHING: All locker parts to be cleaned and coated after fabrication with a seven stage hot-spray washing process and coated with a zirconium-based nanotechnology providing a green alternative to traditional iron phosphate followed by a coat of high grade custom blend powder electrostatically sprayed and baked at 350 degrees Fahrenheit for a minimum of 20 minutes to provide a tough durable finish. Color to be selected from manufacturer's standard list of colors. Body components shall be manufacturer's standard interior neutral (Dark Gray).
- E. Two-Tone Color Combination: Shall be at no additional cost with the locker frame and trim chosen from one color and the doors may be one of any other color chosen from manufacturers standard selection.
- F. Lockers shall be GREENGUARD GOLD Certified.

PART 3 EXECUTION

11.01 INSTALLATION

- A. GENERAL: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.
- B. PLACEMENT: Lockers shall be set in place, plumb, level, rigid, flush and securely attached to the wall (or bolted together if back-to-back) and anchored to the floor or base according to manufacturer's specifications.
- C. ANCHORAGE: About 48" O.C., unless otherwise recommended by manufacturer, and apply where necessary to avoid metal distortion, using concealed fasteners. Friction cups are not acceptable.
- D. TRIM: Sloping tops, metal fillers and end panels shall be installed using concealed fasteners. Provide flush, hairline joints against adjacent surfaces.

ADJUSTMENT

- A. GENERAL: Upon completion of installation, inspect lockers and adjust as necessary for proper door operation. Touch-up scratches and abrasions to match original finish.

END OF SECTION

**SECTION 105200
LOCKER BENCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood Locker Benches.
- B. Wood ADA Locker Benches.

1.02 REFERENCES

- A. ADAAG - Americans with Disabilities Act, Accessibility Guidelines.
- B. IBC - International Building Code.
- C. LEED Submittal Requirements NC v3.0: Sustainable Design Requirements – LEED for New Construction and the LEED NC v3.0 reference guide.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Prepared specifically for this project; show dimensions of lockers and interface with other products.
- C. Submit under provisions of LEED NC v3.0 reference guide: Product data for each type of accessory specified, with installation instructions for each unit built-in or connected to other construction:
 - 1. Product Data for Credit MR 4 – Recycled Content: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
 - 2. Product Data for Credit MR 5 – Regional Materials: Provide documentation indicating where materials have been extracted, harvested or recovered, as well as manufactured. If only a portion of the product has been extracted, harvested or recovered, and manufactured within 500 miles (804.67 kilometers) of the job site, then indicate that percentage.
 - 3. Product Data for IEQ 4.1 – Low Emitting Materials-Adhesives and Sealants: Provide documentation including printed statement of VOC content for all adhesives and sealants.
 - 4. Product Data for Credit IEQ 4.2: Submit product data and MSDS for interior paints and coatings, verifying VOC levels and compliance for Green Seal Standard GS-11, GC-03 and SCAQMD Rule 1113.
 - 5. Laboratory Test Reports for Credit IEQ 4.2: For primers, documentation indicating that products 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".

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a Quality System in place to ensure and be able to substantiate that manufactured units conform to requirements and match the approved design and must be ISO 9001:2015 certified.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging, in a dry, ventilated area until ready for installation.
- B. Locker components shall be stored flat, if shipped unassembled, until assembly. All finishes shall be protected from soiling and damage during handling.

- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 WARRANTY

- A. Manufacturer's standard warranty to repair or replace components of locker products that fail in materials or workmanship within 3 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Salsbury Industries, 18300 Central Avenue, Carson, CA 90746-4008; Toll Free Tel: 800-LOCKERS (800-562-5377); Fax: 800-562-5399; Email: salsbury@lockers.com; Website: www.lockers.com.
- B. Refer to Section 01 2500 for Substitution Requirements.

2.02 LOCKER BENCH

- A. Standard and ADA-compliant wood locker benches: Constructed of solid butcher block wood that is 1-1/4" 1.25 inch (31.75 mm) thick; includes two 3 inch (76.2 mm) diameter bolt mounted pedestals in a black powder coated finish; pedestals include four (4) mounting holes to secure to the ground; combines a classic look with strength and durability. Requires minor assembly.
 - 1. Wood Locker Bench Series:
 - a. 72" Wide x 14" Deep (1,829 mm x 356 mm) Wood Locker Bench.
- B. Unit Heights:
 - 1. [18] inches ([457.2] mm).
- C. Unit Depth:
 - 1. [14] inches ([355.6] mm).
- D. Pedestal Type:
 - 1. Bolt Mounted (BM).
- E. Unit Assembly: Requires minor assembly.
- F. Unit Color:
 - 1. Color: Light - standard.

2.03 CONSTRUCTION

- A. Locker Bench – Seating area:
 - 1. Locker shall made of clear hardwood, 1-1/4 inches (31.75 mm) in thickness.
 - a. All corners are to be rounded and sanded.
 - b. Surfaces shall be finished with two (2) coats of clear lacquer.
- B. Bench Pedestals
 - 1. Pedestals shall consist of aluminum tubing, 3 inches (76 mm) in diameter.
 - 2. Base shall be 1/4" (6 mm) thick aluminum welded to each end of aluminum tubing.
 - 3. Finished in black powder coating.

PART 3 EXECUTION

4.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

4.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

4.03 INSTALLATION

- A. Install in accordance with Salsbury Industry's installation instructions.
- B. Anchor the units to the floor through the bench pedestal's holes:
- C. Bolt-mounted bench pedestals: Four (4) holes.
- D. Free-standing bench pedestals: Two (2) holes; floor mounting optional.
- E. ADA-compliant bench pedestals: Two (2) holes.
- F. Locker benches can be either floor-mounted or installed on concrete or wood bases as scheduled or indicated. Floor or base shall be level for proper installation.

4.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

**SECTION 107300
PRE-FABRICATED ARCHITECTURAL CANOPY SYSTEMS**

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work in this section includes furnishing and installation of all extruded aluminum sunshades with custom designed cantilever support brackets as manufactured by Mapes Industries Inc.
- B. Related Items and Considerations
 - 1. Flashing of various designs may be required. Generic flashing supplied by Manufacturer. Specialty flashing to be supplied by installer.
 - 2. Determine wall construction, make-up and thickness.
 - 3. Ensure adequate wall condition to carry canopy loads where required.
 - 4. Consider water drainage away from area where necessary.
 - 5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.02 QUALITY ASSURANCE

- A. Engineer qualifications: Florida professional engineer licensed in the State.
- B. Products meeting these specifications establish standards of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska 1-888-273-1132.

1.03 FIELD MEASUREMENT

- A. Confirm dimensions prior to preparation of shop drawings when possible.
- B. If requested, supply manufacturer's standard literature and specifications for canopies.
- C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.
- D. Submit color options for architects review/approval.

1.04 PERFORMANCE REQUIREMENTS

- A. Sunshades must conform to local building codes.
- B. PE Stamped calculations are available if specified and per project location.
- C. PE Stamped calculations must be signed and sealed by an engineer licensed within the state the sunshades are installed.

1.05 DELIVER, STORAGE, HANDLING

- A. Deliver and store all canopy components in protected areas.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Mapes Canopies Lincoln, Nebraska Phone: 1-888-273-1132. Fax: 1-877-455-6572.
 - 1. Pre-Engineered SuperShade Cantilever Canopy System, 5' - 0" Maximum projection with cantilever supports. **See Drawings for projection distance.**
- B. Tennessee Valley Metals, Inc.: 190 Industrial Park Road, Oneonta, AL 35121, 800.551.2579

2.02 MATERIALS

- A. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
- B. Cantilever support brackets shall be design engineered per application.
- C. Cantilever support brackets will have standard available finishes.
- D. Fascia shall be standard extruded 8" J style.

2.03 FINISHES

- A. Soffit Finish type shall be PVDF equal to Kynar 500 2 coat.
- B. Fascia Finish type shall be premium finish options as specified. PVDF equal to Kynar 500 2 coat clear anodized., either finish shall match storefront finish.

2.04 FABRICATION

- A. All Mapes SuperShade sunshades are shipped in preassembled sections for ease of installation.
- B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- C. Louver blades shall be all extruded aluminum set on a nominal 45 degree back slant.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Confirm that surrounding area is ready for the sunshade installation.
- B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.02 INSTALLATION

- A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.03 AFTER INSTALLATION, ENTIRE SYSTEM SHALL BE LEFT IN A CLEAN CONDITION.

END OF SECTION

**SECTION 107500
FLAGPOLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Samples: Submit two 12" x 12" in size, illustrating pole material, color, and finish.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: The manufacturer shall provide design the flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work. Provide a professional engineers stamp. The engineer shall note that the flag Pole and foundation are designed for the geographic location of the project.
- B. The Design shall be in accordance with American National Standard Institute / National Association of Architectural Metal Manufacturers (ANSI/NAAMM) Guide Specification for Design of Metal Flagpoles ANSI NAAMM FP 10001-07.
- C. Design with Base wind speed (3 second gust) shall be 140 MPH or ASCE 7-22, which ever is greater.
- D. All poles to be designed to support two two ply polyester flags.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers. Ship as a single flagpole component with no joints.
- B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flagpoles:
 - 1. Concord American Flagpole; Internal - Independence: www.concordamericanflagpole.com/#sle.
 - 2. Morgan-Francis Flagpoles & Accessories: www.morgan-francis.com/#sle.
 - 3. Pole-Tech Co, Inc: www.poletech.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001

1. Material: Aluminum, .156 inch wall thickness, minimum. Brushed Satin AA-M33 directional Textured , no visible seams.
2. Design: Cone tapered.
3. Mounting: Ground mounted type.
4. Nominal Height: Center one (1) pole to be 30 ft (____ m); measured from nominal ground elevation. Each to be shipped in one piece.
5. Halyard: Internal type, manual winch operation. Aircraft grade stainless #10 wire rope cored polyester.
6. Cap Plug: Cast aluminum threaded to accept truck and finial. Plug shall be welded water tight to top of pole. Use caulking in threads to seal inside of pole.
7. Finial: Globe with same finish as pole and 1.5 times the diameter of the top of the pole to reduce flag damage and entanglement.
8. Cleat: Double sided, stainless steel or aluminum cleat with locking mechanism.
9. Flash collar: Same material and finish as pole. Must cover anchor bolts.
10. Truck (block):
 - a. Truck shall cover the entire perimeter of the top of the pole. The truck shall be designed to lift and set the pole with the finial threads or with rope rigging.
 - b. Fixed with single closed or covered, metallic pulley.
 - c. Threaded into cap plug with internal threads to receive finial.
 - d. Pulley axle to be stainless steel.
11. Flag Swivel Snap Hooks: Chrome plated steel, nickel plated steel or stainless steel with stainless springs. Nonswivel hooks are not allowed. Provide gray, vinyl snap covers to prevent flagpole damage.
12. Screws: Stainless screws shall be used to mount all hardware to pole.
13. All flagpoles to have a lightning ground spike.

2.03 POLE MATERIALS

- A. Aluminum: ASTM B221 ASTM B221M , 6063 alloy , T6 temper.

2.04 ACCESSORIES

- A. Finial Ball: Aluminum, ____ inch (____ mm) 1.5 times the top diameter of flagpole. .
- B. Truck Assembly: Stainless steel; revolving, stainless steel ball bearings, non-fouling.
- C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, one per halyard.
- D. Halyard: 5/16 inch (8 mm) diameter polypropylene, braided, wire core. stainless steel wire.

2.05 MOUNTING COMPONENTS

- A. Lighting Ground Rod: 120 inch (____ mm) long copper rod, 3/4 inch (19 mm) diameter. See electrical drawings.
- B. Lightning Ground Cable: Copper No. 6 AWG minimum, soft drawn. See electrical drawings.

2.06 FINISHING

- A. Aluminum: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
- B. Ground Sleeve Anchorage: Minimum 16 Gauge Galvanized, corrugated sleeve embedded a minimum of 15% of the pole height.
- C. Fill foundation tube sleeve with concrete specified in Section 033000.
- D. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.
- E. Mimimum Concrete thickness of 8 inches.
- F. Flag Poles Bases shall be elevated a mininum of (6) inches above grade and positively drained away from pole base.
- G. All Concrete shall be reinfirced with at least temperture and shinkage reinforcement to meet ACI - 318 requirements. Other reinforcement may be required by Maunufaturer's professional Engineer.
- H. Concrete Cover over all reinforcementshall be 3 inches.
- I. Concrete shall have 1/2 inch champher at corners.

3.04 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

**SECTION 114010
FOOD SERVICE EQUIPMENT**

PART 1 - GENERAL

1.01 BASIS OF DESIGN AND SPECIFICATION STANDARDS

- A. The model number and product specifications of the named primary manufacturer, where more than one manufacturer is listed, was used for the basis of design and specification standards for this project with respect to quality, performance, capacities, physical characteristics, appearance, aspect and function.
- B. All manufacturers listed for an item are subject to Architect's approval as a manufacturer for that item; however, the specifications of the primary manufacturer whose product is listed, as the basis of design and specification standards, with a model number and/or description will set the standard for that item. Other manufacturers may modify their product(s) if necessary to comply with the standards set forth herein.

1.02 PRE-APPROVED FOODSERVICE EQUIPMENT CONTRACTORS

- A. Singer Equipment Company, Inc.
(205) 252-0076
- B. Dykes Restaurant Supply, Inc.
(256) 837-1107
- C. Mobile Fixtures and Equipment Company
(251) 342-0455
- D. Hawk - Foodservice Equipment & Supplies
(334) 271-1150

1.03 DEFINITIONS

- A. The following definitions are intended to clarify the relationships involved in this document and are used as a definition throughout this foodservice specification.
- B. Kitchen Equipment Contractor (K.E.C.) - The K.E.C. is the party responsible for the supplying, delivering (including freight, staging and local warehousing as required), assembling, setting in place, installing, cleaning, sanitizing and/or the polishing of any foodservice item(s) included in this contract, but not limited to all required materials and labor, pursuant to the guidelines and time lines scheduled and/or rescheduled by the Owner and/or Architect.
- C. Sub-Contractors - The K.E.C. may contract Sub-Contractors to perform any portion of the contract, but the final responsibility for the proper performance of the contract will rest solely with the K.E.C.
- D. General Contractor (G.C.) - The G.C. has the responsibility for overall installation, scheduling, deliveries, coordination of various trades, rough-in and connection of utilities, including but not limited to all labor and materials for said rough-ins and connections for all equipment in this contract unless otherwise specified, by item, within the equipment data specification sections of this contract. The K.E.C. must coordinate his/her activities and needs with the G.C. in a timely manner as not to delay the project.
- E. The K.E.C. is the party responsible for all taxes, tariffs, duties and/or custom fees and permits where applicable, as may be required. The K.E.C. is contracted by the General Contractor.
- F. N.I.F.C. - Whenever the abbreviation N.I.F.C. is used in this contract, it shall mean the item or items are not part of the Food Service Equipment Contract.
- G. The assignments and/or responsibilities as outlined in this section are subject to change at the Owner's discretion.

1.04 RELATED DOCUMENTS

- A. All drawings, general, special and/or supplementary conditions, Division 1, specifications and related documents apply to this specification.

1.05 PLANS AND SPECIFICATIONS

- A. Should it appear that the work intended to be described or any of the matters relative thereto are not sufficiently detailed or explained on the drawings or in the specifications, the Contractors shall apply to the Architect for such drawings or explanations as may be necessary and shall conform to them as far as they shall be consistent with original drawings.
- B. If any question arises regarding the true meaning of the drawings, specifications and/typographical errors reference shall be made to the Architect whose decision shall be conclusive.
- C. In no instance shall a bid be submitted or any work started with any uncertainty.
- D. Before doing any work or ordering any materials, the Contractors shall verify all measurements of any work and shall be responsible for their correctness. Any differences which may be found shall be submitted to the Architect for consideration before proceeding with the work.
- E. Extra compensation will not be allowed because of differences between actual dimensions and measurements indicated on the working drawings.
- F. Where a conflict occurs between or within standards, specifications, codes, ordinances and/or working drawings the more stringent or higher quality requirements shall apply.

1.06 APPLICABLE DOCUMENTS

- A. Bidding Documents, Contract Forms and related materials issued by, the Project Architect and/or the Owner before awarding a contract apply to this section.
- B. Architectural, Mechanical, Electrical and Structural Plans and other Specifications including all supplements issued thereto and other pertinent documents issued by the Project Architect, and/or the Owner, are a part of these Specifications and the accompanying food service equipment plans and shall be complete within every respect. All the above included herewith, will be issued separately by the Architect or is on file at the Project Architect's office and shall not relieve the Contractors of responsibility or be used as a basis for additional compensation due to omission(s) of Architectural, Structural, Mechanical, Plumbing or Electrical details from food service equipment documents.

1.07 SUBSTITUTIONS

- A. Refer to Section 01 2500 - Substitution Procedures and Section 01 6000 - Product Requirements.
- B. Substitution requests must be supplemented by sufficient information in the form of manufacturer's technical specifications, drawings, pictures and/or samples to evaluate equality, appearance and all other related conditions.
- C. Written substitution requests must be submitted to the Architect in accordance with the guidelines and time lines as set forth by the Project Architect and/or Owner. Substitutions would not be considered if not submitted within these guidelines. Substitutions will not be allowed without prior written approval from the Architect.
- D. All submittals for proposed substitutions must be submitted with an equipment data sheet for each item. The data sheet shall consist of the project name, the Project Architect, the firm submitting, the item number, the manufacturer, the manufacturer's model number, a complete written description of what is to be provided, an accessories and options list of what is to be provided, finishes, dimensions, utility requirements as provided (ie: gas: natural or lp, electrical: voltage/phase and amps, plumbing/mechanical: water/sewer, etc.) as well as type of connection. The data sheet shall have a blank space (3-1/2"w x 5"h) in the lower right corner of the sheet for stamping, etc. This information must be submitted not less than fifteen days from the bid due date to be considered as an alternate.

- E. Where substitutions are made by the Contractor with the written approval of Project Architect, the K.E.C. shall be responsible for and pay all costs of any consequential modifications which may result from the substitution.
- F. If the K.E.C. decides to submit an alternate manufacturer and receives a written response from the Project Architect accepting this change, then all resulting expenses incurred in the changes or additions to the food service equipment work as well as other contractors work shall be the sole responsibility of the K.E.C. and shall be considered as part of the base bid with no additional compensation permitted.
- G. The Manufacturer and model number of any article, device, material and/or form of construction listed in the "Itemized Specifications" as the "Primary Manufacturer" shall establish the "Basis of Design and Specification Standard", with respect to the physical dimensions, characteristics, aspects, capacities, performance and/or quantities required herein. If K.E.C. chooses to utilize one of the approved listed manufacturers then they must provide submittal information to the Architect for analysis and conclusive determination with respect to that item.
- H. Accepted substitutions will be noted in an addendum issued by the Architect. No other substitutions and/or deviations from the primary manufacturer will be permitted subsequent to the date of the Bid Opening, except by specific change order and only with sufficient cause. The approval of a substitution does not approve, relieve and/or change the Contractors responsibilities as outlined herein.

1.08 INTENT

- A. It is the intent of the Contract Documents for each and every item and/or component to be complete with all required devices and standard features necessary for that item and/or component to properly function.
- B. It is the intent of the Contract Documents for each and every item and/or component to function and perform in a manner equal to the Primary Manufacturer's intent. K.E.C. is required to notify the Project Architect in writing of any or all discrepancies or omissions of any components prior to submitting bid.
- C. Failure of the K.E.C. to report any discrepancies and/or omissions prior to submitting his bid shall not relieve the K.E.C. of his responsibilities for providing complete, functioning, workable systems in full accordance with the intent of the Contract Documents.

1.09 WARRANTIES AND GUARANTEES:

- A. Equipment and Appliance Warranties: Furnish manufacturer's standard written product warranties, any special project warranties and guarantees indicated for individual pieces of equipment, and any incidental equipment component warranties.
- B. Warranties and guarantees shall be in addition to, shall be in effect simultaneously with, and shall not alter or limit other project or product warranties or guarantees, nor shall they serve as limitations to other remedies available to the Owner.

PART 2 - SCOPE

2.01 WORK INCLUDED

- A. Work required under this section consists of providing all necessary services, tools, equipment, material and labor required to provide the continuous installation (the term installation shall mean the complete installation including, but not limited to, the delivery of all food service equipment items and necessary components complete with transportation charges and taxes prepaid by the K.E.C. to the job site's location) as designated on the food service equipment plan, uncrated, erected, set in place, leveled and made ready for final connection, by G.C., to plumbing, gas, electrical and/or steam utilities and properly anchored and/or trimmed as may be required.
- B. K.E.C. is to deliver all parts and/or components, which are to be built into cast-in-place concrete and/or masonry in ample time for inclusion in the concrete and/or masonry work. Furnish necessary setting plans and/or instructions, oversee the installation of all parts in the masonry

and/or concrete and be responsible for the correctness and accuracy of the location and installation.

- C. K.E.C. to provide holes, ferrules and/or stainless steel chases on equipment for pipes, drains, electrical outlets, conduits and similar items as may be required to coordinate and accommodate the installation of the food service equipment in connection with the work of other contractors.
- D. K.E.C. to provide the necessary materials, labor, services and incidentals necessary for the completion of these sections of work including but not limited to adhesive, caulking, sealing, trim strips, chases, corner guards, corner trims and/or closure panels.
- E. K.E.C. to provide items and components hereinafter specified and/or shown on plans, completely assembled or erected in locations indicated, ready for final connections to service, by the respective trades. The labor and material(s) required for final connections are the responsibility of G.C.
- F. K.E.C. to provide and install where required fasteners, flashing, trim strips, filler panels, cant strips and caulking and/or sealant required to complete the installation.
- G. All roof, wall and/or floor assemblies including finishes (as specified herein) penetrations, openings, curbs, platforms and/or dunnage pursuant to the requirements of the food service ventilation and/or refrigeration items are to be provide and installed by the G.C. unless specified otherwise.
- H. Keep premises clean and remove from the site all crates, cartons and other debris resulting from the work. Leave all areas "broom cleaned" and all equipment items and furnishings "construction clean". Final cleaning, sanitizing and polish of all equipment items and furnishings shall be done by the K.E.C. Further, it is the K.E.C.'s responsibility to provide protective coverings for all equipment items delivered to the job site during construction.

2.02 RELATED WORK OF OTHER CONTRACTORS

- A. General Construction by G.C.
 - 1. All floor assemblies including finishes, openings, depressions, sleeves, curbs and bases;
- B. All wall and/or partition assemblies including finishes, openings, recesses, sleeves, furring and backing;
- C. All ceiling assemblies including finishes, openings, soffits, access panels, fire separation and sleeves;
 - 1. All roof assemblies including finishes, openings, curbs, platforms and dunnage;
 - 2. All structural supports or grounds for hanging or fastening of food service equipment assemblies as may be described in this section;
 - 3. G.C. to provide on-site storage trailer(s) and security for owner's existing and/or provided food service equipment to be used on this project, if applicable.
- D. Plumbing by G.C.
 - 1. Water, gas and steam supply systems, as required;
 - 2. Sanitary and grease laden drainage systems;
 - 3. Final plumbing connections including mounting of drains, faucets and piping from point of connection on equipment to building plumbing systems and interconnections between equipment components.
 - 4. Grease traps.
 - 5. Indirect drain line runs from equipment items to nearest floor drain or floor sink as required;
 - 6. Gas shut off valve(s) as required for ventilator fire suppression system and gas regulators on individual pieces of gas fired equipment in accordance with the manufacturer's recommendations are to be provided by the K.E.C. and installed by the G.C.;
 - 7. K.E.C. to furnish faucets with nipples, elbows, supply lines and valve stops, drains and/or splash mounted vacuum breakers, etc. for each equipment item as specified herein. Items to be installed by the G.C.

8. All exposed plumbing related to or in connection with food service items to be chrome plated;
 9. Indirect wastes shall be chrome plated and are to drip over and into floor drains. Where drains and/or supply lines run under equipment, provide the proper support from the underside of the equipment to eliminate interference with cleaning and/or maintenance.
- E. Electrical by G.C.
1. All electrical distribution, lighting and power systems except otherwise specified in this section;
 2. Final electrical connections and inter-connections including labor and materials from point of connection on equipment to building electrical systems and required interconnections between equipment components;
 3. All electrical materials including wire, conduit, over current protection, main switches, safety cut-outs, shunt-trip breakers, disconnect switches, lightning control devices, surge protectors, uninterruptible power units and controllers;
 4. Shunt-trip breakers and/or contactors and all conduits and for shut down of electrically operated cooking equipment and/or ventilation equipment as required for ventilator fire suppression system.
 5. Empty conduit systems for refrigeration system, as specified and/or shown on food service drawings.
 6. Empty conduit system for point-of-sale system, as specified and /or shown on food service drawings.
 7. Empty conduit system for fire suppression system, as specified and/or shown on food service drawings.
 8. K.E.C. shall furnish all electrically operated portable and/or movable equipment items with factory installed 3-wire or 4-wire heavy duty insulated cord with a grounded plug with one leg of the cord grounded to a conductible portion of the items frame;
 9. Furnish and install switches and/or disconnects within equipment, contactors combination starters with fused disconnects, controls and similar items necessary for the safe and proper operation of the equipment and for compliance with all N.E.C. and/or local AHJ requirements.
 10. All switches, disconnects and/or control devices shall be safely accessible without reaching across or over any hot and/or hazardous equipment items.
 11. F.E.C. to secure cords, to the underside of the equipment, on portable and/or movable equipment as to allow ease of maintenance or as required by the owner.

2.03 RELATED WORK BY OWNERS

- A. Install Owner furnished equipment in accordance with the installation section of this document, unless otherwise specified herein.

PART 3 - QUALITY ASSURANCE

3.01 EQUIPMENT

- A. Equipment, with the exception of "buy-out" or standard catalogue items, shall be fabricated in a plant bearing the name of a recognized food service equipment fabricator. This fabricating firm shall have been in business at least five years, with a suitable organization to design, engineer, manufacturer, deliver and install the equipment. Said installation shall be accordance with local union conditions when applicable. Such firms shall be able to refer to other successful installations of similar operating conditions. Further, the fabricator shall be able to UL classify and list the items that they fabricated. Under no circumstances shall the K.E.C. sublet any portion of the fabricated equipment to any sub-contractor without the CDS's written approval. All fabricated food service equipment with inter-wiring and/or pre-wired equipment and/or refrigeration shall be manufactured by a fabricator that can UL list (or other applicable AHJ listing) and/or classify their own work.

3.02 LABOR

- A. All labor shall be performed by experienced mechanics in this type of work. All work on the premises shall be done at such time as to promote the proper conduct of the project. Provide a competent on-site superintendent to supervise the work and to provide other trades with such information necessary to maintain proper conduct and timely completion of the work.

PART 4 - CODES, LAWS AND STANDARDS

4.01 GENERAL REQUIREMENTS

- A. Manufacture and install equipment in conformance with the Williams-Steiger Occupational Safety and Health Act of 1970, or other Local/National safety and health regulations as applicable.
- B. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
 - 1. National Fire Protection Association (NFPA)
 - a. NFPA 96-Installation of equipment for removal of smoke and grease-laden vapors from commercial cooking equipment, current edition.
 - b. NFPA 17 -Dry chemical extinguishing systems, current edition.
 - c. NFPA 17A-Wet chemical extinguishing systems, current edition.
 - 1) NFPA 70-National Electric Code.
 - 2. National Sanitation Foundation (NSF)
 - 3. Underwriter's Laboratories, Inc. (UL), including but not limited to UL-300
 - 4. National Electric Manufacturers Association (NEMA)
 - 5. American Gas Association (AGA)
 - 6. American Society for Mechanical Engineers for Steam Equipment
 - 7. National Fuel Gas Code (NFGC)
 - 8. State Board of Health Regulations (10-D-13)
 - 9. International Mechanical Code (IMC) 2006
- C. All electrically operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of the National Electric Manufacturer's Association and the Underwriter's Laboratories, Inc., where applicable standards have been set up by that agency, or otherwise, such as to be acceptable to authorities having jurisdiction.
- D. Note: For projects outside the U.S., compliance is required for any and/or all governing codes and regulations as may be required by the local AHJ.

PART 5 – SUBMITTALS

5.01 GENERAL REQUIREMENTS

- A. Shop drawings, samples and brochures must be submitted at the same time, in one complete submittal, within sufficient time not to delay work on the project and / or not over 15 days after the G.C. has been awarded a contract by the Owner. Partial submittals will not be accepted.
- B. Equipment List: Submit for approval, within 15 days after notification of the Owner's award of contract, an itemized list of equipment to be furnished under this contract, to include manufacturer's name and model number, along with all necessary and/or required options and/or components, for each piece of equipment - necessary only if not using primary manufacturer and if prior approval for a substitute has been let.

5.02 SAMPLES

- A. Provide all samples of materials requested by the Architect for test purposes or comparisons.
- B. Samples used for testing shall not be used on the work without the written approval of the Architect.
- C. Samples may be retained by the Project Architect or the Owner as a matter of record without any additional compensation to the Contractors.

5.03 BROCHURES

- A. Provide the Project Architect, for approval, three (3) complete brochures for review showing each piece of standard manufactured equipment, only if primary manufacturer(s) are not used, complete with all details and/or descriptions of the manufacturer's specifications. Contractors will return one (1) brochure (set) with comments noted for further action. Continue submitting until final approval from the Project Architect is achieved. After approval provide ten (10) record copies in a three ring binder with such details and specifications clearly numbered with the item number as per the food service equipment plans with operators manuals, service agency information and local rep. details for each item specified.
 - 1. Record copy brochures, shall be delivered at the demonstration and start-up, are to be bound in booklet form, in three ring binders, and shall include the following:
- B. A separate data sheet for each component or item of equipment indicating item number, description, quantity, manufacturer, model number, finishes, modifications, options and utility requirements.
- C. Catalog specification sheet and / or manufacturer's specifications and drawings complete including accessories. Arrange booklets so those items are in numeric order in accord with the contract documents with each page numbered in relation to that item. Further, include with each specification sheet and/or drawing a copy of the warranty information, operations manual and service information; as well as, a completed contractor's and the food service equipment contractor's guarantee and warranty.

5.04 SHOP, ROUGH-IN AND/OR MECHANICAL CONNECTION DRAWINGS

- A. K.E.C. is to provide the Project Architect (1) set of shop drawing prints for review and comment by the Architect. One (1) print with comments noted will be returned for correction.
- B. K.E.C. to prepare rough-in drawings locating all equipment (new, existing or as provided by owner) shown on the contract documents. The rough-in requirement drawing included in these documents are provided as an instrument of service and are not to be used for construction and/or reproductions. Provide drawings, in 1/4"=1'-0" scale on sheets the same size as the contract documents, showing, with vertical and horizontal dimensions, the required rough-ins (including sleeves and conduits) for electric, gas, water, steam, sanitary waste, refrigeration, ventilation, condensation drain lines, air and exhaust connection and wood backing for wall mounted fixtures and equipment. Show details, sections and characteristics for slab depressions and/or other features and/or installation including data for all services in each area. Locations of equipment shall allow for traps, switches, and/or other final connection requirements. All drawings shall include floor plans shown equipment as per the contract documents, elevations, details and sections as may be required-only required if not utilizing primary specified manufacturer.
- C. Fabrication details must identify all metal gauges, hardware, trim, electrical parts, special fitting and other components by manufacturer's name and model number.

5.05 CHECKING

- A. Checking of rough-in drawings, shop drawing, details and equipment by the Architect is for design concept only and does not relieve the K.E.C. or G.C. / C.M. of responsibility for compliance with design drawings, details and specifications, verification of utilities with equipment requirements for conformity and location and verification of all dimensions of equipment, building conditions or reasonable adjustments due to deviations.

PART 6 - PRODUCTS

6.01 EQUIPMENT SCHEDULE: REFER TO SCHEDULE AT END OF SECTION

6.02 PRODUCT OR MANUFACTURER APPROVAL

- A. The product of the primary manufacturer named, where more than one manufacturer is listed, was used for the basis of design and specification standard and sets the standard of quality, appearance, performance, aspect, capacities and function for that item.
- B. **Only products of listed primary manufacturers will be acceptable unless requests for substitutions and/or submittals of alternate manufacturers are submitted to the Architect**

in accordance with stated conditions. Alternate manufacturers are approved as a manufacturer; however, each item for an alternate manufacturer must be submitted to the Architect for approval/rejection.

- C. Other manufacturers must modify their product if necessary to comply with the quality, physical and functional characteristics of the primary manufacturer and must be approved by the Architect.
- D. All manufacturers listed may not be able to supply an equipment item, pursuant to the specifications, as standardized by the primary manufacturer whose name and model number was utilized herein as the basis of design standard for this project, in which case, the listed alternate manufacturers may elect to modify an item to meet the specifications.

PART 7 – INSTALLATION

7.01 PLACEMENT

- A. Do all fitting and fastening necessary to install fixed items or sub-items in permanent position as shown on plans.
- B. Place all portable items or sub-items which do not require plumbing or electrical services as shown on plans or as directed by SSA / Project Architect.

7.02 ERECTION

- A. Work shall be erected plumb, square and unwrapped by experienced personnel.
- B. Protect all metal surfaces in contact with masonry, concrete and/or dissimilar metals with and acceptable nonabsorbent tape and/or gasket material.
- C. Work shall be erected in correct horizontal and vertical alignment at the locations shown on the drawings.
- D. Frames shall be anchored in place with sufficient anchorage to withstand live load with no apparent movement or tendency to fail.
- E. Installation screws and fasteners shall be installed carefully to avoid scratching and/or damaging adjacent surfaces and/or fastener heads and shall be stainless steel.
- F. At completion of erection work, finished surfaces shall be free of hammer and tool marks, scratches, blemishes, rust and stains.
- G. Equipment shall be suitably protected, by K.E.C. during installation to prevent damage by other trades.
- H. Provide general &/or seismic restraining devices in areas requiring such, as per local codes.

7.03 CLEARANCE

- A. Edges of splashes on open base fixtures that are adjacent to walls shall have a 3" cleaning clearance or be sealed, seal bead not to exceed 3/8", against wall.
- B. Edges of splashes on closed base fixtures that are adjacent to wall or other solid fixtures higher than the splash shall form tight hairline joints. Seal joints with transparent Geoprene, General Electric or Dow silicone sealant. All excess sealant to be cleaned out to a smooth radius fillet.

7.04 FIELD JOINTS

- A. Field joints in stainless steel and/or brass tops shall be welded or fused and finished as specified herein.

7.05 UTILITY SERVICE CONNECTIONS

- A. Plumbing, electrical and mechanical furnished by the K.E.C. shall be limited to that which is built-in or is an integral part of the equipment itself.
- B. Final utility installation and connections shall be by related trades and is to be included in the G. C.
- C. Provide restraining devices with mobile cooking equipment as required.

7.06 CONTRACTOR COOPERATION

- A. Cooperate with and render all necessary assistance to other Contractors concerned with roughing-in and final connection of utility services for this contract.
- B. After final utility connections are made, thoroughly clean , sanitize, polish and inspect the proper function of all items.
- C. Report malfunctioning, incomplete or missing items, Owner furnished equipment or components to CDS/ Project Architect.

7.07 ACCEPTANCE

- A. Architect will inspect the completed work connected with this section for compliance to the Contract Documents, upon notification by the General Contractor or K.E.C. which ever occurs first.
- B. Prior to acceptance of the work of this Section, K.E.C. shall clean, sanitize, polish and treat all stainless steel, cast iron, enamel porcelain and other type surfaces in accordance with manufacturer's recommendations and/or procedures.
- C. Prior to acceptance of this Section, K.E.C shall clean and retouch all painted surfaces, powdercoated surfaces that have been damaged must be re-finished by an established powder-coating firm.

7.08 TESTING, DEMONSTRATING AND INSTRUCTING

- A. Stipulated retainage of payment shall be mandated by the Owner. Retainage will be released only after the requirements of this section of these specifications are met in their entirety and to the complete satisfaction of the Owner's Project Manager.
- B. K.E.C. shall at the completion of this work remove all debris, crating, packaging materials and implements associated with this work leaving the area broom clean.
- C. K.E.C. shall provide and maintain protective covering for finished surfaces and other parts of equipment and/or cooler/freezer assemblies subject to damage during and after installation.
- D. Clean, test, adjust, calibrate by a factory authorized service agency all foodservice equipment and fixtures to make ready for operation when the facility is turned over to the Owner.
- E. After the above is complete, all items furnished under this Contract shall be operated and thoroughly tested to insure proper safe operation. The Architect, Owner, and the G.C shall be notified of this testing and is to be provided with a copy of the service agencies' report.
- F. When the food service equipment has been cleaned and tested and is operating properly, the K.E.C. shall arrange to have equipment furnished under this section of the contract demonstrated, pursuant to the availability of the Owner and it's representatives, by authorized representatives who are to instruct the Owner's designated personnel in the use, care and maintenance of the equipment. NOTE: Attendance at the demonstration meeting is required of all manufacturers' designated representatives providing equipment under this Contract and is to occur at one meeting.
- G. The K.E.C. shall be responsible for scheduling the demonstration meeting. Each manufacturer's representative shall be present at this meeting:
 - 1. Demonstrate to and instruct the Owner's designated personnel as to the operation, use, care, cleaning and maintenance of all items of equipment and respond to all questions and concerns by written response.
 - 2. Provide the Owner's designated representative with the name, address and telephone number of a designee of each manufacturer and state which designee shall be responsible to quickly respond to warranty work 24 hours a day, 365 days a year. This is to be direct contact. The Owner may contact such warranty representatives designee directly, and such designee may respond without voiding any responsibility or warranties of the manufacturer, the K.E.C., the G.C. Service charges for this warranty representative, no matter what the resolution of the problem may be, shall be the responsibility of the manufacturer, the K.E.C., the G.C. In any event, the K.E.C. shall be

responsible to immediately pay upon invoice, charges by the warranty representative in order to keep the warranty representative responsive. Whether the plumbing, electrical, food service equipment or other sub-contractors (or even the Owner) should be back charged will be resolved later.

3. Provide the Owner's representative with three (3) sets of operation maintenance manuals for each item of equipment furnished under this contract. This set shall be neatly bound in a three ring binder, by K.E.C. with the delivery of this booklet receipted at the time of delivery.
4. Attendance at the one demonstration meeting is required of all manufacturers' representatives providing equipment under this contract, if for any reason an additional meeting must be scheduled the K.E.C. will be responsible for all additional fees and costs incurred.

PART 8 - CORRECTION OF DEFECTS, SERVICES AND GUARANTEE

8.01 GENERAL

- A. K.E.C. shall replace, at the Owner's, the Project Architect's discretion, or make satisfactory repairs to any item of equipment that fails to conform to the requirements of the Contract at the time and shall remedy any defects due to faulty materials or workmanship which appear within a period of one (1) year from start-up and demonstration of equipment.
- B. Items shall be tested and adjusted by skilled mechanics and this Contractor shall guarantee the material and workmanship of the equipment furnished by him under these specifications, for a period of one (1) year after acceptance by Owner.
- C. All equipment, refrigeration systems and ice makers shall have start-up and a two (2) year extended service warranty for parts and labor and five (5) year extended warranty on compressors which will start on the date of Owner's acceptance. The cost of all warranties shall be included in the bid proposal and contract sum and shall serve as a prepaid service contract.
- D. Contractors who do not normally maintain local refrigeration service personnel shall be required to provide the Owner with a refrigeration service policy in writing from local refrigeration service company that maintains a twenty-four (24) hour call service and that is acceptable to the Owner for a period of one (1) year at no additional expense to the Owner
- E. Provide to Owner a listing of factory authorized service agencies and copies of written service and warranty agreements on all items of equipment provided under this contract, excluding Owner furnished and/or existing items.
- F. Service contracts on refrigeration systems must be contracted for by the K.E.C. with authorized local service organizations capable of providing prompt and efficient service. Submit six copies of all service contracts, as specified herein, upon completion of the installation of the equipment to the Owner.

PART 9 - MISCELLANEOUS REQUIREMENTS

9.01 UNIFORM QUALITY

- A. Custom built items must be constructed by the same fabricator to insure uniform quality and appearance.
- B. Similar type items of manufacture and/or prefabricated equipment must be the product of the same manufacturer.

9.02 IDENTIFICATION PLATES

- A. Each piece of equipment must have a suitable nameplate supplied by the manufacturer that is to include the name of the manufacturer, the electrical and/or utility demands.
- B. Each switch and/or control device shall have an approved nameplate indicating its function or purpose such as display shelf lights, frost plate compressor and plate warmer.

- C. Indicator dials and other standard components of prefabricated equipment will be considered acceptable identification of their physical location clearly indicating the warmers and/or other equipment items that they control.
- D. All nameplates must be non-corrosive metal with engraved letters or have acid etched, phenolic and / or painted letters.

PART 10 – FOOD SERVICE EQUIPMENT SCHEDULE

ITEM # 101 REACH-IN REFRIGERATOR

Quantity: Two (2)
Manufactur: General Foodservice
Model: T-23-HC

Refrigerator, reach-in, one-section, (1) stainless steel doors, (3) PVC coated adjustable wire shelves, interior lighting, stainless steel front, aluminum sides, aluminum interior with stainless steel floor, 4" stem castors (2 with brakes), R290 Hydrocarbon refrigerant, refrigerator 1/4 HP, cULus, UL EPH Classified, Made in USA

- One (1) Self-contained refrigeration standard
- One (1) Warranty - 7 year compressor (self-contained only)
- One (1) Warranty - 3 year parts and labor
- One (1) Left door hinged left, right door hinged right standard
- Four (4) Additional PVC coated wire shelf, each (shelf clips included)
- Four (4) 4" stem castors, standard (adds 5" to OA height)

Utilities: Refer to Architectural Drawing

Acceptable Alternates: Beverage Air

ITEM # 102 REACH IN FREEZER

Quantity: One (1)
Manufactur: General Foodservice
Model: T-23F-HC

Freezer, reach-in, one-section, (1) stainless steel doors, (3) PVC coated adjustable wire shelves, interior lighting, stainless steel front, aluminum sides, aluminum interior with stainless steel floor, 4" stem castors (2 with brakes), R290 Hydrocarbon refrigerant, freezer 1/2 HP, cULus, UL EPH Classified, Made in USA

- One (1) Self-contained refrigeration standard
- One (1) Warranty - 7 year compressor (self-contained only)
- One (1) Warranty - 3 year parts and labor
- One (1) Left door hinged left, right door hinged right standard
- Four (4) Additional PVC coated wire shelf, each (shelf clips included)
- Four (4) 4" stem castors, standard (adds 5" to OA height)

Utilities: Refer to Architectural Drawing

Acceptable Alternates: Beverage Air

ITEM # 103 HEATED HOLDING PROOFING CABINET, MOBILE

Quantity: Two (2)
Manufacturer: Carter-Hoffmann
Model: HL4-18

Humidified Holding Cabinet/Heater Proofer-HL4 Series, one compartment, full height, insulated, (36) 12" x 20" or (18) 18" x 26" pan capacity, 3" fixed wire universal slides, (1) single pane tempered glass door, bottom-mount forced air heat with water reservoir, mechanical controls, aluminum construction, (4) 5" swivel casters (2 with brakes), ETL, ETL-Sanitation

- Two (2) 3 Year parts & labor warranty, standard

Two (2) Low wattage for US

Two (3) Single pane tempered glass door in extruded aluminum, standard

Utilities: Refer to Architectural Drawing

Acceptable Alternates: Cres-Cor, F.W.E.

ITEM # 104 ICE MAKER WITH BIN, CUBE-STYLE

Quantity: Two (2)

Manufacturer: Manitowoc

Model: UYF-0190A

Undercounter Ice Maker, cube-style, air-cooled, self contained, 26"W x 28"D x 38-1/2"H, production capacity up to 193 lb/24 hours at 70°/50° (140 lb AHRI certified at 90°/70°), 90 lb ice storage capacity, electronic controls, full bin and service indicators, production delay of (4, 12, or 24 hours), Alpha-San anti-microbial protection, forward sliding storage bin for access to refrigeration components, sealed foodzone with removable water trough, distribution tube and damper door, half-dice size cubes, 6" adjustable legs with flanged feet (painted gray), 0.42 HP, NSF, cULus, CE

Utilities: Refer to Plumbing, Electrical, and Architectural Drawings.

Acceptable Alternates: Hoshizaki, Scotsman

ITEM # 106 RESIDENTIAL ADA-COMPLIANT DISHWASHER

Quantity: One (1)

Manufacturer: Whirlpool

A. Model: WDT550SAPZ

B. ADA-Compliant residential built-in under-counter dishwasher. Stainless steel fingerprint-resistant door with aluminum handle, stainless steel tub, nylon rack material, Energy Star Qualified, NSF Certified, 5-cycle selection, three racks and bottom rack dishwasher basket, three wash arms, sound package, water filtration system with removeable filter, drain hoses, 15 Amps, 60 Hz, 120 Volts.

C.

D. Dimensions: 32.3125 inches high, 23.5625 inches wide, 22.625 inches deep. Coordinate with interior elevations and casework shop drawings.

E. Utilities: Refer to Plumbing, Electrical, and Architectural Drawings.

F. Provide power cord as required for complete installation.

END OF FOOD SERVICE EQUIPMENT

END OF SECTION

**SECTION 116500
GYMNASIUM EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gymnasium Equipment
 - 1. Overhead-supported Basketball Backstops.
 - 2. Equipment Controls.
 - 3. Wall Pads
 - 4. Telescopic Seating - **Refer to Section 11 6600 "Telescopic Seating"**

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.
- C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.03 RELATED SECTIONS

- A. Section 03 3000 - Cast-In-Place Concrete
- B. Section 05 1200 - Structural Steel Framing
- C. Section 05 5000 - Metal Fabrications
- D. Section 05 4000 - Cold-Formed Metal Framing: Wall Pad Furring at PEMB Rigid Frame.
- E. Section 06 1000 - Rough Carpentry: Wall Pad Furring at PEMB Rigid Frame.
- F. Section 09 6460 - Wood Athletic and Sports Flooring
- G. Section 11 6600 - Telescopic Seating
- H. Section 16 526 - Interior Electronic Scoreboard

1.04 REFERENCES

- A. ASTM E84- Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM F2440- Standard Specification for Indoor Wall/Feature Padding.
- C. NFPA 255- Surface Burning Characteristics of Building Materials.
- D. NFPA 286- Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- E. NFPA 701- Methods of Fire Tests for Flame-Resistant Textiles and Films.
- F. GREENGUARD Certification for Children and Schools.

1.05 DESIGN REQUIREMENTS

1.06 SUBMITTALS

- A. Comply with Section 01330 (01 3300) - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.
- C. Specification Sheets:
 - 1. Submits manufacturer's specification sheets, including sections and details, indicating dimensions, tolerances, materials, fabrication, connections, finish, options, and accessories.
- D. Samples: Submit manufacturer's color samples
 - 1. Wall Padding

2. Backboard Edge Padding
- E. Test Reports: Submit manufacturer's certified test reports from testing performed by accredited independent testing laboratory, indicating compliance of materials with requirements as specified.
- F. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- G. Manufacturer's Project References: Submit manufacturer's list of recently completed projects, including project name and location, name of architect, and type of gymnasium equipment installed.
- H. Installation and Maintenance Manual: Submit manufacturer's Installation and Maintenance manual.
- I. Warranty: Submit manufacturer's standard and additional warranties.

1.07 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide gymnasium equipment from single manufacturer.
- B. Manufacturer's Qualifications: Minimum of 5 consecutive years of experience manufacturing gymnasium equipment similar to that specified.
- C. Installer's Qualifications: Trained and approved by manufacturer.
- D. Regulatory Requirements: Gymnasium equipment shall conform to latest rules and regulations:
 1. National Collegiate Athletic Association (NCAA)

1.08 WARRANTY

- A. Provide 1-year warranty against defects in materials and workmanship, unless otherwise specified, starting from the date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Porter Athletic, Inc., 601 Mercury Drive, PO Box 1790, Champaign, Illinois 61824-1790. Toll Free (888) 277-7778. Phone (217) 367-8438. Fax (217) 239-2255. Web Site www.porterathletic.com. E-Mail porter@porterathletic.com.
- B. Approved Equals:
 1. Draper, Inc. 411 South Pearl St, Spiceland, Indiana 47385 USA (765) 987-7999.
 2. Performance Sports Systems, 9200 E 146th St. A, Noblesville, IN 46060 (317) 774-9840.

2.02 OVERHEAD-SUPPORTED BASKETBALL BACKSTOPS.

- A. Basis of Design
 1. Model No. 90923000 Rear-fold, rear-braced, overhead-supported basketball backstop.
- B. System Description
 1. Frame: Fully welded, vertical front frame assembly consisting of main center Mast of 6-5/8-inch O.D. heavy-wall structural steel tube with diagonal side sway braces of 2-1/2-inch rectangular steel tube. Bolt-together frames are not acceptable.
 2. Structure: Supported by 3-1/2 inch (89 mm) O.D. pipe or tube anchored to overhead framing members with heavy formed-steel support fittings. Fittings must be capable of supporting load exceeding 10,000 lbs with sufficient attachment points and meeting safety factor of 60 to 1. Furnish certified test results with submittals.
 3. Goals: Mount directly through backboard and into heavy structural steel weldment Center-Strut, clamped to vertical 6-5/8-inch O.D. center support to eliminate strain on backboard, should player hang on front-mounted goal and to be in compliance with NCAA and NFHS requirements.
 4. Pipe Ends: Cap when exposed.
 5. Finish: Metal Parts, Pipes, and Fittings shall be powder coated. Color to be selected by Architect from Manufacturer's standard colors.

6. Attachments: Clamping devices used in attaching backboards and other components shall be of u-bolt design providing uniform clamping force around mast, Clamps that provide non-uniform clamping will not be considered equal.
 7. Forward Fold, Front Braced, overhead-supported basketball backstops (Main Basketball Court Backstops - 2 total) to include shot clock bracket support to suspend a shot clock from Porter's 6-5/8" backstop mast.
 8. Safety Indicator Clamp Required: Mast Attachment Indicator must be capable of supporting backboard and all weight attached to the mast with a minimum safety factor of 4, with visible indication if indicator clamp is supporting weight or if any attachments have moved.
 9. Frame Hangers: Tested to 20,000 pounds maximum breaking point to achieve safety factor of 50 to 1. Furnish certified test results with submittals. Minimum of 2-inches of adjustability for precise plumbing of backstop.
 10. Frame Hangers: Offset minimum of 1-1/2 inches (38 mm) from center line of main center mast to properly weight lock unit in playing position.
 11. Brace: Operate with 2-3/8-inch O.D. brace with folding mechanism that locks backboard in playing position with internal torsion spring that must be mechanically disengaged by the hoist cable.
 12. Warranty: 25 Year limited warranty on backstop structure.
- C. Winch System: Model 713- 1 HP Electric Winch
1. Hoist Cable: Of sufficient length to each backstop. 1/4-inch diameter 7x19 galvanized aircraft-type cable, minimum of 7,000 pounds ultimate.
 2. Drum: Will hold 41ft of cable on a single layer. The top speed of the cable is 14.3 feet (435.86 cm) /min.
 3. Swivel Pulleys: 4-inch diameter cast iron pulley sheave with maintenance-free, oil-impregnated bearing for proper hoist cable routing to winch.
 4. Pulley Assembly and Attachment to 3-1/2-Inch O.D. Support Structure: Rated at minimum 9,000-pound load rating. Furnish certified test results with submittals.
 5. Hold units at any position when raising or lowering.
 6. Saf Strap: Provide speed sensitive automatic lock designed to engage in the event of an over-speed occurrence. Must be able to withstand test using 1750 lb. fall weight. Must be able to provide independent lab test results. Capable of being automatically reset without the use of poles, ropes, levers, or buttons.
 7. Warranty: 5 year limited warranty.
- D. Basketball Backboards: Model 208- Rectangular Glass Backboard
1. Backboards: 2-5/16-inch thick frame, 72 inches (1828.8 mm) by 42 inches (1066.8 mm), 1/2-inch tempered plate glass cushioned in fully welded, unitized steel-tubing frame.
 2. Perimeter: Glare-free aluminum.
 3. Goal Mount Structure: Provided with two mounting holes and hardware to independently secure backboard to a direct mount goal feature which relieves all stress and shock on the backboard frame.
 4. Standard White Borders and Target Area: Fired into glass permanently.
 5. Warranty: Limited lifetime warranty against breakage when installed on Porter Center-Strut support systems.
- E. Basketball Backboard Padding: Model 00326999- Bolt-on Edge Pads (EACH)
1. Provide for each rectangular glass backboard, along bottom of backboard and up 15 inches (381 mm) on each side, meeting AHSAA, NCAA, NFHS, NBA, and FIBA rules.
 2. Pads: 2-inch thick, molded from 9-pound density polyurethane foam with integral skin.
 3. Color: Selected by Architect from Manufacturer's standard colors.
 4. Warranty: 10 year limited warranty.
- F. Basketball Goals: Model 236054 Ultra-Flex II goal

1. Goal: Positive-lock, pressure-release mechanism which is preset to provide rebound characteristics identical to those of a non-movable ring. Spring-loaded to return automatically and instantaneously to playing position.
 2. Pressure Release Mechanism: Factory preset with capability for field adjustment to comply with NFHS, AHSAA, and NCAA recommendation to test goals for rebound elasticity.
 3. Breakaway goals with plastic-pivot bearings are not acceptable.
 4. Rim: 18-inch diameter, made with 5/8-inch diameter cold drawn, alloy steel, rigidly braced by 3/16-inch thick steel formed & die-cut steel brace welded in position on underside of rim for maximum support. Inside diameter of ring shall be positioned 6" from face of backboard by a heavy formed steel, hinged type housing with a removable cover to conceal mounting bolts and spring mechanisms of goal, and protect against finger entrapment.
 5. Goal Mounting Plate: Shall be provided with hardware and a 5" x 4" mounting hold pattern.
 6. Net Attachment: Tube-tie net attachment system on rim to eliminate conventional wire-formed net locks.
 7. Net: Anti-whip, white net.
 8. Warranty: 5 year limited warranty when installed on Porter Center-Strut support systems.
- G. Basketball Backboard Height Adjuster: Model No. 00900506 Manual Height Adjuster- Center Strut
1. Provide manual height adjuster at all overhead supported basketball backstops.
 2. Function: Height adjustment unit shall be designed for use with No. 900 Center-Strut® series ceiling suspended basketball backstop support systems to provide an adjustable, direct-mount (Center-Strut®) goal attachment system to eliminate any strain on the backboard should a player hang on the front mounted goal (conforms to the latest NCAA recommendation). Height adjustment units without the prescribed direct-mount goal feature will not be approved as equal. Height adjustment feature will allow goal height settings from 8'-0" to the official 10'-0" for use by all age groups. For use with No. 208 rectangular glass backboards.
 3. Materials: Center unitized support frame shall be fabricated by dual, 2-3/16" square heavy-wall zinc plated guide tubes located on 11-3/16" centers. Ends of guide tubes shall be welded to heavy, formed mounting brackets. Heavy formed, die cut steel clamp assemblies (2) shall be provided for securing height adjustment assembly directly to a 6-5/8" O.D. center support structure (No. 900 Center-Strut® series basketball backstops). Outer dual slide tubes shall support heavy structural steel angle sections which extend downward to accept a direct-mount (Center-Strut®) goal mounting system. Slide tube assembly shall be provided with a heavy formed steel section to attach a special upper backboard support assembly to secure the unit to the upper two corners of the rectangular backboard on standard (5'-6") mounting centers.
 4. Adjustment Mechanism: Height adjustment unit shall incorporate a centrally located 3/4" diameter acme threaded rod equipped with precision, hardened steel roller thrust bearings for ease of operation from the playing floor by means of an awning crank mechanism. Height adjustment system shall incorporate an internal, spring-loaded height locking mechanism to automatically lock and hold unit at any desired goal height during play. Lock mechanism automatically releases when height setting changes are made with adjustment crank assembly. Adjustment crank assembly shall be provided for every (6) height adjustment units.
 5. Height Setting Scale: Shall be located on the side of the unit to visually determine height settings from 8'-0" to 10'-0" in 3" increments.
 6. Coating: Height adjustment frame shall be finished with one coat of flat black enamel.
 7. Mounting: Hardware shall be furnished for mounting unit to a 6-5/8" O.D. vertical support tube.
 8. Warranty: Furnished with a 1-year limited warranty.

2.03 EQUIPMENT CONTROL

A. Model No. 12700000 Powr-Touch 4

1. Operation: Touchscreen control system capable of operating a maximum of 128 basketball backstops or other gymnasium equipment and a maximum of 32 units of auxiliary gymnasium electrical equipment.
2. Operation Safety: For safety of operation, touch screen requires constant pressure on on-screen button to control gymnasium equipment. Auxiliary Equipment controlled by single touch of on/off button.
3. Equipment shall be operated individually or simultaneously by pressing single button. Control systems incapable of simultaneous control operation shall not be considered equal.
4. Equipment shall be able to be operated either up or down by pressing a single button. Systems incapable of operating different pieces of equipment in both up and down directions simultaneously shall not be considered equal.
5. Operate all types of equipment in a single operation.
6. Quick Courts: System shall have capability to field-program preset memory court operation configurations. Systems not capable of field-programmable operation memory settings shall not be considered equal.
7. System backup: Controller shall accept USB stick for storing backup program configurations of the system, including field-programmed quick court settings.
8. Security Code: Four-digit reprogrammable security code to prevent unauthorized use. Second programmable security code for access to change touchscreen passcode or equipment relay assignment.
9. Time Delay: Touch screen shall automatically revert back to secure mode if no button is used within 30 seconds.
10. Multiple Locations: Maximum of 7 touch screens may be used when operation from various locations is desirable.
11. Mounting: Surface mounted on top of standard 2-gang electrical box, 4 inches (101.6 mm) by 4 inches by 2-1/2 inches (64 mm), with 12-volt control circuit to relay panels located remotely.
12. Relay Panels: Minimum of 1 dual-powered relay panel, with a maximum of 16 relay panels per network. Each relay panel shall contain 2 banks of eight 30-amp relays for operating 8 momentary-controlled type (up and down), 120-volt or low-voltage pieces of equipment. Each bank of relays shall be independently powered by 120-volt line power, with 2 dedicated circuit breakers per relay panel. Each relay panel shall include 2 maintained 30-amp relays.
13. Relay Panel Enclosure: 4-3/8 inches (111 mm) by 14 inches (355.6 mm) by 17 inches (431.8 mm).
14. Touchscreen: Full color touch-sensitive 7.0 inch (177.8 mm) backlit WVGA LCD display with 800x480 resolution.
15. Warranty: 1 year limited warranty.

2.04 WALL PADS

A. **Typical Wall Pad** - Basis of Design: Model No. 9056028XX Durasafe Wall Pad No Nailing Margin

1. Wall Pad Dimensions: 2 FT 0 IN Wide by 7 FT 0 IN High
2. Foam: 2 in Thick, Polyethylene Foam
3. Interior Foam: Bonded to 7/16-inch oriented strand wood board to minimize warping.
4. Panel shall meet the min. ASTM F2440 standard specification for impact rating.
5. Vinyl-Coated Polyester Cover shall meet the requirements for Class A Rating (flame spread 0-25, smoke development 0-450) when tested in accordance with ASTM E-84.
6. Entire Face of Panel: Shall be upholstered in 19-Ounce, fire-retardant, high-tensile, vinyl-coated polyester fabric material with leather-like embossed finish.
7. Cover Material Properties: Mildew resistant, rot resistant, with infection-combating fungicide.
8. Cover shall be folded and securely stapled to backside of the OSB.

9. Color: Selected by Architect from manufacturer's standard colors.
10. Warranty: 5 year limited warranty.

B. Wall Pad Attachment Clips - Basis of Design: Model No. 00347100 and 00347200 z-clip panel attachment clips.

1. Material: Heavy, precision extruded aluminum with attachment holes pre-drilled.
2. Attachment method: Securely locking wall pads in place by means of z-clip interlocking attachment.
3. No. 00347100 wall attachment clip: shall be 6'-0" in length with the capability of field cutting to length as required
4. No. 00347200 panel attachment clip: shall be 1'-10" length with hardware for attaching to 2'-0" wide panels. 2 panel attachment clips shall be furnished for each wall pad.
5. Panel attachment hardware: to be furnished with 00347200 clips.
6. Wall attachment hardware: to be furnished by other trades or installing contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, area, and conditions, with installer present, for compliance with requirements for play court layout, alignment of mounting substates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the work.

3.02 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required
- B. Unless other indicated, install gymnasium equipment after other finished operations, including painting.
- C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout
 1. Operating Gymnasium Equipment: Verify Clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components
- D. Wall Pads:
 1. Mount with bottom edge at 4 inches (101.6 mm) above finished floor
 2. Preparation:
 3. Inspect areas and conditions where wall padding and padded safety floor mats will be installed. Notify the Architect of any condition that would adversely affect the installation or subsequent utilization of the equipment. Do not proceed with installation until satisfactory conditions are corrected.
 4. Coordinate wall padding and padded safety floor mats installation with work of other trades. Provide setting diagrams, dimensions, and templates for items that must be built in during other construction operations
 5. Installation:
 6. General: Install all wall padding and padded safety floor mats in accordance with the manufacturer's recommendations and approved shop drawings. Set wall padding plumb, true and level, and secure anchored in place
 7. Mount with bottom edge flush with floor padding
 8. Cutout Trim; Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange
 9. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensures that wall padding is without damage or deterioration at time of Substantial Completion.

- E. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.
- F. Connections: Connect electric operators to building electrical system

3.03 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operation range; and lubricate as recommended in writing by manufacturer.
- B. Remove packaging and other debris from the project site.

3.04 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION

**SECTION 116600
TELESCOPIC SEATING**

1.01 WORK INCLUDED

- A. Manufacture, deliver and install Telescopic Seating Systems in accordance with applicable codes, the following specifications, and approved drawings.

1.02 RELATED WORK BY OTHERS

- A. Adequate floor levelness and strength for operation of telescopic seating.
- B. Adequate wall strength for attachment and operation of wall attached telescopic seating.
- C. Electrical wiring within the building as required for power operated telescopic seating.

1.03 SYSTEM DESCRIPTION

- A. Telescopic seating system shall be multiple tiered seating rows comprised of seat and deck components, risers, and supportive understructure.
- B. Telescopic seating shall be operable on the telescopic principle, stacking vertically in minimum floor area when not in use.
- C. The first moving row, on manual sections, shall be secured with release lever. All other rows shall be mechanically locked, operable only upon unlocking and cycling of first row. Power sections shall be secured with mechanical locks as well as the power system, operable upon activating the pendant control.

1.04 QUALITY ASSURANCE

- A. DESIGN LOAD CRITERIA (STRUCTURAL): International Building Code Standard: Comply with requirements of IBC / ICC 300, Chapter 4 "Standard for Bleachers, Folding and Telescopic Seating and Grandstands Assembly Seating," except where other requirements are indicated by the architect/owner.
- B. Partial Loading Requirements: Telescopic seating governed by IBC 2018, ICC-300 2017, NFPA 102 2016 or NFPA 5000 2018 shall all comply with ASCE 2016, Section 4.3.3 Partial Loading.
- C. Manufacturer: Company specializing in telescopic seating with a minimum of 5 years' experience in manufacturing telescopic seating.
- D. Engineer Qualifications: Manufacturer to employ an Florida registered, licensed Professional Engineer to certify that the equipment to be supplied meets or exceeds the design criteria of this specification.
- E. Installation: Shall be handled directly by the manufacturer or by a factory certified installation subcontractor.
- F. Product Liability: Certification of insurance coverage of not less than \$5,000,000. Provide insurance certificate in owners name with architect and consultants added as insured.
- G. Welding Processes: To be performed by certified professional welding operators in accordance with American Welding Society – Certified Welding Fabricator, (AWS-CWF), D1,1 "Structural Welding Code-Steel."
- H. Product Improvements: Equipment provided shall incorporate manufacturer's design improvements and materials current at time of shipment, provided that such improvements and materials are consistent with the intent of these specifications.

1.05 SUBMITTALS

- A. BID SUBMITTALS
 - 1. Manufacturer's descriptive literature and specifications.
 - 2. List of deviations from these specifications, if any.
 - 3. Certification of Insurance.
- B. JOB SUBMITTALS

1. Shop Drawings showing all equipment to be furnished with details of accessories to be supplied including necessary electrical service to be provided by others. All electrical submittals must include U.L. listing number.
2. Provide samples of material and color finish for Architects review and approval.
3. Warranty, operation and maintenance instructions to the owner upon completion.

1.06 DESIGN CRITERIA

- A. Telescopic seating shall be designed to support, in addition to its own weight, and the weight of added accessories, a uniformly distributed live load of not less than 100 lbs. per sq. ft. (4.8 kN per sq. m.) of gross horizontal projection. Seat boards and footrest shall be designed for a live load of not less than 120 lbs. per linear foot (1.751 kN per linear m).
- B. Sway force applied to seats shall be 24 lbs. per linear ft. (350 N per linear m.) parallel to the seats and 10 lbs. per linear ft. (146 N per linear m.) perpendicular to the seats. Sway forces shall not be considered simultaneously applied.
- C. Railings, posts and sockets designed to withstand the following forces applied separately.
- D. Handrails shall be designed and constructed for:
 1. A concentrated load of 200 lbs. (890 N) applied at any point and in any direction.
 2. A uniform load of 50 lbs. per ft. (730 N/m) applied in any direction.
 - a. The concentrated and uniform loading conditions shall not be required to be applied simultaneously.
- E. Guards shall be designed and constructed for:
 1. A concentrated load of 200 lbs. (890 N/m) applied at any point and in any direction along the top railing member and; a uniform load of 50 lbs. per ft. (730 N/m) applied horizontally at the required guardrail height and simultaneous uniform load of 100 lbs. per ft. (1460 N/m) applied vertically downward at the top of the guardrail. The concentrated and uniform loading conditions shall not be required to be applied simultaneously.
 2. A concentrated load of 200 lbs. (890 N/m) applied at any point and in any direction along the top railing member and; a uniform load of 50 lbs. per ft. (730 N/m) applied horizontally at the required guardrail height and simultaneous uniform load of 100 lbs. per ft. (1460 N/m) applied vertically downward at the top of the guardrail. The concentrated and uniform loading conditions shall not be required to be applied simultaneously.
- F. American Institute of Steel Construction (AISC), American Iron and Steel Institute (AISI) and Aluminum Association (AA) design criteria shall be the basis for calculation of member sizes and connections.
- G. Wood members shall be designed in accordance with National Forest Products Association, (NFOPA), and National Design Specification for Wood Construction.

1.07 WARRANTY

- A. The manufacturer shall warrant all work performed under these specifications to be free of defects for a period of one (1) year, starting from the date of substantial completion.
- B. All understructure components shall be warranted for a period of ten (10) years, starting from the date of substantial completion.
- C. Any materials found to be defective within this period will be replaced at no cost to the owner. This warranty shall not include replacements required by Acts of God, war, vandalism, flood, fire, calamity or deliberate abuse or misuse of the equipment.

2.01 ACCEPTABLE MANUFACTURERS

- A. All seating shall be VersaTract Telescopic Seating System as manufactured by Irwin Seating Company - Telescopic Division, Altamont, IL 62411 or approved equal, subject to prior approval and strict compliance with these specifications.
- B. Substitution Limitations:

1. Where approved manufacturers and specific products are listed, submit data on such manufacturer's product which is equal to the Basis of Design product for approval by the Architect. Comply with requirements listed in the individual specifications - per sections 01 2500, 01 6000, and 01 3000.
2. Additional manufacturers may submit substitution requests in accordance with procurement substitution and/or substitution procedures, and provide comparable products with the following support information detailed below
3. Written documentation stating specification compliance regarding construction, materials, and standard of quality and manufacturing techniques must be made by addendum prior to bid.
4. Note all deviations to the drawings and/or specifications in writing.
5. Provide the Architect with a full scale seat sample not less than 10 days prior to the bid date. The sample shall represent the exact seat proposed and shall meet the standards set forth in the specifications.
6. The Owner, or its designated representative, reserves the right to reject any proposal that in their opinion fails to meet the criteria established by this specification. Such decision shall be final.

2.02 MATERIALS

- A. Seating Area: Verify all dimensions and job conditions prior to fabrication.

2.03 FABRICATION

- A. Understructure System:

1. Steel supports and rolling frames shall be constructed from formed steel of the size and shape necessary to support the design loads. All support bracing shall begin at Row 2 and be of diagonal or "knee" type for rigidity. Diagonal bracing to be minimum 1 1/2" x 1 1/2" 14-gauge square tubing. Bracing fabricated from open-sided channel, angle iron or flat strap "X" type bracing is unacceptable.
2. Wheels shall not be less than 5" diameter x 1 3/8" non-marring soft rubber face to protect wood or synthetic floor surfaces. Each operating row shall have a minimum of 6 wheels.
3. Each fully skirted wheel channel shall be formed 12-gauge steel and continuously in contact with adjacent channels by means of an Integral Alignment System (IAS) and include nylon glides to eliminate any metal to metal contact. The IAS maintains proper alignment between adjacent wheel channels for smooth and consistent operation while eliminating the potential for accidental row separation. Wheel channel alignment systems with metal to metal contact requiring periodic lubrication or that utilizes a guide rod system that can be bent or damaged will not be acceptable.
4. Each cantilever arm shall be triple-formed 10-gauge steel, securely welded to the post assembly and include a nylon cantilever pad to ensure smooth operation. The cantilever pad shall also provide a firm base when in the occupied position and provide a solid feel when walked on.
5. Vertical columns shall be high tensile steel structural tube to meet design criteria. Minimum column size to be 2" x 3" 14-gauge structural tube, welded to a 2' wide wheel channel using 360 degrees of weldment.
6. Deck support members shall be double formed 14-gauge steel and connect the front nosing and rear riser members. Each deck support shall include a unique dual-purpose roller that provides smooth support during operation. The deck support roller shall also include a 3/4" wide shoulder that's encapsulated by the deck support on the row above in order to maintain proper upper alignment while delivering consistent, repeatable operation.

- B. Seat Systems:

1. Infinity Seat: Supply plastic modular 18" individual seats in either 10" deep models. Seating to be scuff resistant injection molded high density polyethylene plastic.
2. 10" Infinity Seat to be supplied:

- a. Seat modules supplied shall be of a high aesthetic design using multiple textures, style lines and a waterfall front. The rear of the seat shall be slightly curved to eliminate the straight line appearance and include a moderate seat contour and texture to enhance spectator comfort.
 - b. Seating design shall be molded to achieve a finished end appearance without the use of end caps. The rear of the seat shall include a smooth wall allowing for the deck to be easily swept clean without obstruction.
 - c. Seat heights shall be maintained at a minimum of 16 3/4". Lower seat heights which detour from spectator comfort will not be accepted.
 - d. Foot space shall be maximized for spectator comfort and provide a minimum of 22" when measured with a 10" module.
 - e. Each seat to be designed with the capability of using seat numbers and row letters at the aisle locations. Seat numbers to be stylishly designed using a radius corner to enhance the aesthetic value of the seat. Seat numbers and row letters shall be recessed into the seat to protect against any vandalism.
 - f. Select seating colors from manufacturer's 15 standard colors. Custom colors available as an option. Owner may pick up to 3 colors.
 - g. Securely fasten each seat to the nose beam using a 10-gauge formed steel bracket and locking hardware. Adjacent seating shall be interlocked together along the full perimeter eliminating any fore or aft movement or the potential of any pinching hazard.
 - h. Seat modules shall be designed to support a uniform load of 600 lbs per seat and a concentrated load of 150 lbs over 4 square inches.
- C. Deck System:
1. Panelam decking shall have a 0.030 (30 thousandths) high density polyethylene overlay, permanently bonded over a structural deck panel meeting all flooring load requirements. Deck panels shall be supported along the front and back edge for maximum rigidity and connected using a tongue and groove splice leaving the deck clean and free of any tripping or cleaning obstructions. Decking shall be secured in place by the encapsulation of the rear riser and mechanical fasteners along the front edge. Panelam to be selected from manufacturer's standard colors. Finish thickness to be 5/8".
- D. Nosing:
1. Nosing shall be one piece, formed, 14-gauge steel with a minimum G-60 pre-galvanized finish.
- E. Rear Risers:
1. Rear riser shall be one piece, formed, 14-gauge steel with a minimum G-60 pre-galvanized finish.
- F. Finish:
1. For rust resistance in standard conditions all painted surfaces shall be finished in textured Epoxy Powder Coated Semi-Gloss Black.

2.04 ACCESSORIES

- A. Aisles shall be footrest level [54] inches ([1371.6] mm) wide to provide 6 aisles. Aisles at the footrest level shall include non-slip treads on the top front edge.
- B. Intermediate aisle steps shall be provided. Steps are permanently attached closed design. Steps shall be constructed from 14 ga. steel, finished in a Black powder coated epoxy, and designed to eliminate any possible toe catch between the top of the intermediate step and the bottom of the nose beam per ADA or other applicable codes. Front step shall be removable and interlock to the front row eliminating any possibility of accidental disengagement, and store on the front row when not in use.
- C. Aisle handrails.
 1. Smart Rail aisle handrails shall be provided for 22" to 26" row spacing. Aisle railings shall quickly and easily rotate 90 degrees to the locked position and store parallel to the front of

the aisle. Railings that require removal from the pocket or the use of tools for storage will not be acceptable. Aisle railings shall be an individual rail design, located on every other row starting at row two (2). Railing to be constructed of 1 1/2" 11 ga. round steel tubing, finished in a textured powder coated epoxy. For safety, railings designed without a full return of the handrail will not be acceptable.

- D. Wheel Chair Seating Areas.
 - 1. Permanent wheel chair spaces shall be provided at the section joint location or section length as shown on plans. Permanent notches to have a Panelam closure panel to eliminate any open areas under the system. Closure panels to support row two eliminating damage to the understructure or the need for front railings.
 - 2. End rails of the self-storing type, finished with textured epoxy powder-coated black enamel, shall be provided at the open ends of the group. End rails shall start at row three and be constructed from 1" square tubing to meet all national building codes. Railings with flexible uprights that can be expanded beyond the 4" sphere are not acceptable.
 - 3. End panels of plywood and supports shall be provided to enclose the open ends of the group in the closed position. End panels shall enclose the space between the wall and the back of the self-storing end rails. End panels to be constructed from Panelam or clear coat plywood.
- E. Vinyl end curtains: shall be provided to limit unauthorized access to the underside of the telescopic system. Curtain to be one piece design shaped to follow the angle of the telescopic unit in the open position and constructed of a sturdy vinyl material with sewn-in grommets for attachment. Color to be selected from manufacturer's standard selection for Architects approval.
- F. Seat level rear filler panels up to 21" deep used to close openings between top row seat and wall. Provide adequate support structure below the closure panel that will allow for spectators to safely stand in this area. Closure panel to match the deck surface.

2.05 PROPULSION SYSTEM

- A. FRICTION POWER: Integra Drive System (IDS) shall be furnished on each seating group to open and close the telescopic units. Each individual section shall include 2 IDS friction drive systems integrated into the first moving row of understructure to achieve smooth and efficient operation. Operation of the seating shall be accomplished with the use of a walk along pendant control.
 - 1. Each IDS power system shall include large 6 1/2" diameter friction rollers to develop tractive force adequate to open and close the system. Each roller to include non-marring 1/2" thick rubber covering.
 - 2. Electrical motors for each section shall be heavy-duty and high efficiency gear reduction motors. The shaft diameter for the gear motor and rollers shall be a minimum of 1" and be connected by a 1" schedule 40 drive shaft.
 - 3. All roller chain and sprockets used throughout the drive system shall be a minimum of #40 ([1016] mm) size. Each drive unit shall be designed to include a safety shroud around the chain and sprocket for overall safety.
 - 4. The power units shall develop tractive forces adequate to operate the seating units under normal conditions but inadequate to operate should significant obstacles be encountered.
- B. Manufacturer shall provide all wiring from power source within bleacher seating including pendant control. Removable pendant control shall be handheld with forward and reverse button, plugging into a single receptacle. Electrical contractor shall provide a 60 HZ power source (as specified below) behind each group of seating. Amperage to be as specified by seating manufacturer depending on the number of power units required. For wall-attached installations, power source to terminate in a surface mounted junction box above floor. For reverse units, power source to terminate in a junction box, flush mounted under first seating row in center of group. Electrical contractor shall perform the connections to the seating equipment at the junction box. All electrical parts and wiring shall be installed in complete accord with the National Electric Code. U.L. Listing FHJU.E479554.

1. Supply power system with 208/230V, 5 wire 3-phase system.

3.01 REVIEWS AND APPROVALS

- A. Shop drawings shall be approved and job site field measurements taken prior to installation and telescopic gym seating shall be installed in conformance therewith.

3.02 INSTALLATION

- A. The installation of the telescopic gym seating will be handled directly by the manufacturer or by a factory authorized installation subcontractor qualified to perform the installation function.

3.03 PROTECTION

- A. The manufacturer's representative shall transmit instructions in both operation and maintenance to the owner.
- B. Maintenance and operation of the telescopic gym seating shall be the responsibility of the owner or his duly authorized representative, and shall include the following:
 1. During operation of the telescopic gym seating, the opening and closing shall be supervised by responsible personnel who will assure that the operation is in accordance with the manufacturer's instructions.
 2. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the telescopic gym seating.
 3. An annual inspection and required maintenance of all telescopic gym seating shall be performed to assure safe conditions. At least bi-annually, the inspection shall be performed by a Professional Engineer or factory service personnel. The one year inspection shall be provided by the subcontractor performing the telescopic seating work.
- C. Irwin Telescopic Seating Company constantly strives to improve its product and manufacturing methods; therefore, it reserves the right to make changes without notice which, in the opinion of Irwin Seating Company, shall improve the product.

END OF SECTION

**SECTION 122413
ROLLER WINDOW SHADES**

1.01 SUMMARY

- A. Section Includes
 - 1. Motor-operated roller shades with single rollers.
- B. Related Requirements
 - 1. Section 06 10 00 "Rough Carpentry" - wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 07 92 00 "Joint Sealants" - sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. installer qualifications: Fabricator of products in use.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 WARRANTY

- A. Roller Shade Hardware Warranty: Manufacturer's non-depreciating warranty for interior shading.
 - 1. Shade Hardware: 10 years unless otherwise indicated.
 - a. Mecho/5 with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - b. ElectroShade with ThermoVeil, EuroVeil, EuroTwill, Soho, Equinox, Midnite, Chelsea, or Classic Blackout shade fabric: 25 years.
 - 2. Standard Shadecloth: Twenty-five-year warranty.

3. Ecoveil Shadecloth: Ten-year warranty.
4. Roller Shade Motors, Motor Control Systems, and Accessories: Non-depreciating five-year warranty.
5. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts, or other means to reach inaccessible areas, which are deemed Owners' responsibility.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Draper Inc.
 2. Hunter Douglas Contract
 3. Lutron Electronics Co., Inc.
 4. Mechoshade Systems, Inc.
 5. Springs Window Fashions; SWF contract
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.02 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Keyed Control Stations: Keyed, momentary-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 - c. Color: **As selected by Architect from manufacturer's full range.**
- B. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. Operating Features:
 1. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
 2. Capable of accepting input from building automation control system.
 3. Override switch.
- D. Automatic Solar-Evaluation Control System:
 1. Basis of Design: MechoShade Systems LLC; SolarTrac. Utilizes ASHRAE Clear Sky algorithms to incrementally adjust shade positions maximizing energy management, daylighting, occupant view, and occupant comfort. Sky model calculated on a daily basis.
 2. System Capacity: Supports up to 65,000 zones / 65,000 motors.
 3. Platform: Windows Service. Supports Windows PC, Windows Server, and Windows Virtual Machine.
 4. Communications Riser/Backbone: Manufacturer-approved communications riser/backbone and switches for communication at floor/areas. Support dedicated Ethernet network, building/BMS Ethernet network, and RS485 riser/backbone implementation.
 5. Algorithms: Calculate the following on a continuous basis; once every five seconds, 24 hours per day, 365 days per year, for each window / storefront.

- a. Solar Heat Gain: Btu/hour/sq foot (W/sq m) multiple times per minute.
- b. Incident angle.
- c. Profile angle.
- d. Direct radiation.
- e. Diffuse radiation.
- f. Surface azimuth.
- g. Solar surface azimuth.
- h. Algorithms to include consideration of:
 - 1) Window geometry/profile, including window overhangs.
 - 2) Allowable solar depth of penetration.
 - 3) Sky condition based on input from roof-mounted solar radiometers.
6. Internet Weather: Supports Internet weather coupled with wireless daylight sensors for determination of sky conditions where roof-mounted solar radiometers cannot be used.
7. Shade Positioning:
 - a. Align shades up to 256 positions.
 - b. Calculate positioning resolution once every minute.
 - c. Stagger operation of shade motors for electrical load balancing.
8. Override Capability:
 - a. Automatic Override of Shade Positions for the Following:
 - 1) Cloudy Sky Conditions: Based on input from roof-mounted solar radiometers. Shades go to predetermined position maximizing occupant view and available daylight.
 - 2) Bright Conditions: Based on input from wireless daylight sensors and user-defined allowable brightness ratio. Requires Brightness Override Module. Shades go to predetermined position to maximize occupant comfort.
 - 3) Dark Conditions: Based on input from wireless daylight sensors. Requires Darkness Override Module. Shades go to predetermined position to maximize occupant view and available daylight.
 - 4) Facades and Zones: In shadow due to adjacent structures (e.g. buildings, trees, etc) as determined by three-dimensional model and user-defined timing parameters; requires Shadow Override Module option; shades to go to predetermined position to maximize occupant view and available daylight.
 - 5) Reflections from adjacent structures or features (e.g. buildings, bodies of water, etc.) as determined by three-dimensional model; requires Reflection Module option; shades to go to predetermined position to maximize occupant comfort.
 - b. Manual temporary override of shade positions:
 - 1) IQ Switch low-voltage wall controls or touchscreen manual override panels.
 - 2) Browser Interface: Enables control of individual shade motors, shade groups, or zones. Administrative settings allow for assignment of shade control restrictions for specific users.
 - c. Configurable resumption of automatic control following manual temporary override event based on wake, sunrise, sunset, sleep, time duration, and specific times.
9. Data Logging:
 - a. Periodic: Roof-mounted solar radiometer and wireless daylight sensor data, Internet weather. Store at rate of once per minute.
 - b. On Change: Shade position, shade status, overrides, alerts/errors, sky conditions, user login/logout, setting/configuration changes, remote access commands/overrides (e.g. BMS, A/V, etc.).
10. Browser User Interface:
 - a. Interactive Floor Plan: Graphical map of each floor for setup, monitoring, and control. Pan and zoom navigation.
 - b. Access to adjustable parameters and displays current values including but not limited to:
 - 1) Radiation.

- 2) Shade position.
- 3) User-defined requirements.
- c. Display current sky conditions based on input from roof-mounted solar radiometers.
- d. Zone/Sensor Monitoring: Display current operation of selected zones or sensors.
- e. Manual/Master Override:
 - 1) Interactive Floor Plan: Graphical map of each floor showing shade groups, zones, and sensors with current position of each zone.
 - 2) Universal Command View: Enables whole floor/building control.
- f. Alerts/Notifications:
 - 1) Display real time event notification including gateway or motor not responding, motor in wrong position, motor overridden, and zone overridden.
 - 2) Display manual overrides from touchscreen manual override panels. Bbrowser and remote/third party interface (BMS, A/V, etc).
 - 3) Configurable for email alerts and notifications.
- g. Reports/Analysis:
 - 1) Data Storage/Event Log: Continuous daily activities record.
 - 2) Current Day's Activity: Visual record of zone operations by intermediate stop locations.
 - 3) Trending Reports:
 - (a) Daily: Includes sky, sensors, event log, and timeline.
 - (b) Shade Position: Percentage of time shade spent at each position.
 - (c) Override: Reason for override and percentage of day shade spent overridden up/down.
 - 4) Zone history analysis.
- h. Multi-level user access. 1,000 user accounts, with 100 simultaneous users. Utilize security certificates.
- 11. Configurable Zone Properties:
 - a. Minimum move timer: For restricting frequent shade movement.
 - b. Wake and sleep time and position.
 - c. Window geometry (overhangs, fins, sill height).
 - d. Profile angle; minimum and maximum.
 - e. Auto position; minimum and maximum.
 - f. Night position.
 - g. Cloud position.
 - h. Position and threshold for overcast.
 - i. Bright overcast.
 - j. Bright clear.
 - k. Bright cloudy.
 - l. Darkness sky conditions.
 - m. Sunset/sunrise offset and position.
 - n. Allowable solar penetration; maximum.
 - o. Solar heat gain; minimum.
 - p. Solar heat gain thresholds per preset position.
 - q. Number of preset positions.
 - r. Multi-tier zone settings (number of tiers or window heights).
 - s. Tandem mode zones.
 - t. Retract mode enable/disable.
 - u. Sensor bindings (which sensors affect selected zone).
- 12. Integration with Other Systems: Support third party systems including building management systems (BMS), lighting control systems, audio-visual (A/V) systems, HVAC control systems, and energy dashboards via BACnet (BTL certified), Ethernet UDP, Ethernet TCP/IP, REST API, and RS485.
- 13. Accessories:

- a. Solar Radiometers: Rooftop measurement of sky conditions. Quantity of three unless otherwise indicated.
 - b. Sunrise/Sunset Sensors: Supplementing solar radiometers. Accurate measurement of sky conditions during sunrise/sunset periods.
 - c. MechoNet Wireless Daylight Sensors: As specified for automatic override of shade positions for bright conditions. Communicates wirelessly to MechoNet Wireless Controller configured for SolarTrac mode.
 - d. MechoNet Wireless Occupancy Sensors: As specified for automatic override of shade positions based on occupancy status. Communicates wirelessly to MechoNet Wireless Controller configured for SolarTrac mode.
 - e. Touchscreen Manual Override Panels: Manual temporary override of shade positions. Enables manual control of shades via touchscreen interface with graphical map of shades for local area.
 - f. Low-Voltage Wall Controls; IQ Switch: As specified for manual temporary override of shade positions.
- E. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle- end assemblies designed to facilitate removal of shadebands for service.
1. Direction of Shadeband Roll: Regular, from back of roller.
 2. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- F. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- G. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- H. Shadebands:
1. Shadeband Material: As indicated in Finish and Materials Legend.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- I. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
 2. Endcap Covers: To cover exposed endcaps.
 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.03 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

**SECTION 123600
COUNTERTOPS AND WINDOW SILLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Countertops for manufactured casework. (Refer to Section 06 4100 - Architectural Plastic Laminate Casework)
- C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry
- B. Section 064100 - Architectural Wood Casework.
- C. Division 22 - Plumbing Fixtures: Sinks.
- D. Section 07 9005 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- F. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification:
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Solid Surface Tops: Solid surfacing sheet or plastic resin casting over continuous substrate. Refer to drawings for colors and locations of solid surface countertops.
 1. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers: **See finish schedule for Basis of Design.**
 - 1) Avonite Surfaces; []: www.avonitesurfaces.com/#sle.
 - 2) Dupont; []: www.corian.com/#sle
 - 3) Formica Corporation; []: www.formica.com/#sle.
 - 4) Wilsonart; []: www.wilsonart.com/#sle.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 2. Other Components Thickness: [1/2] inch ([] mm), minimum.
 3. Coordinate with other trades.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

- A. Fabricate countertops and backsplashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 3. **All overhanging edges at casework to be built up to 1 1/4 inch vertical height, except at sinks, where 1/2" thickness is acceptable.**
 4. **Provide 1/8 inch radius at all edges of countertops and backsplashes.**
 5. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4____ inches (____ mm), unless otherwise indicated.
- C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

- A. Clean countertops surfaces thoroughly.
- B. Clean other solid surface material thoroughly.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 124813
ENTRANCE FLOOR MATS AND FRAMES**

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes the following types of entrance flooring systems:
 - 1. Floor Mats & Frame Assemblies.
 - 2. Floor Grids & Frame Assemblies.
- B. Related Sections: The following sections contain requirements related to this section:
 - 1. Grouting frames into recess; refer to Sections 03 3000 - Cast-In-Place Concrete
 - 2. Section 09 0561 - Common Work Results for Flooring Preparation

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. The Aluminum Association.
- C. The Carpet and Rug Institute (CRI).
- D. The National Floor Safety Institute (NFSI).
- E. International Organization for Standardization (ISO).
- F. Cradle to Cradle Products Innovation Institute (C2C).

1.03 SUBMITTALS

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01300.
- B. Product data for each type of floor mat/grid and frame specified including manufacturer's specifications and installation instructions.
- C. Shop drawings in sufficient detail showing layout of mat/grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.
- D. Samples for verification purposes: Submit an assembled section of floor mat/grid and frame members with selected tread insert showing each type of color for exposed floor mat/grid, frame and accessories required.
- E. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats/grids.

1.04 QUALITY ASSURANCE

- A. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m².
- B. Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.
- C. Standard rolling load performance to be 1000 lb./wheel (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).
- D. Single Source Responsibility: Obtain floor mats/grids and frames from one source of a single manufacturer.
- E. Utilize superior structural aluminum alloy 6105-T5 for rail components.
- F. Utilize a manufacturer that is ISO 9001 & 14001 certified.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.06 PROJECT CONDITIONS

- A. Field measurements: Check actual openings for mats/grids by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. **Recessed Conditions: IMPORTANT: Coordination with Division 03 0000 Concrete specifications is required. For proper installation, the concrete recess must be flat and smooth throughout. If the recess is formed by a concrete contractor, the pour dimensions may require leveling grout to achieve the proper depth and a smooth finish. The final recess depth will match the specified product and must be field verified. For proper frame installation, the side walls of the concrete recess must also be straight and smooth. Inconsistencies with the recess and side walls must be remediated prior to product installation.**

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. Construction Specialties, 3 Werner Way, Lebanon, NJ 08833 USA 800-233-8493; email: cet@c-sgroup.com.
- B. Drawings and specifications are based on manufacturer's literature from **Construction Specialties, Inc.** unless otherwise indicated. Other manufacturers must be approved equal by Architect/Owner.

2.02 MATERIALS

- A. Aluminum - ASTM B 221, alloy 6105-T5, 6105-T6 for extrusions.
- B. Flexible and prime TPE extrusions.
- C. Tread insert options - refer to section 2.05.

2.03 FLOOR MATS

- A. Model and Description - G4 PediTred- Cradle 2 Cradle Silver certified. Shall be extruded 6105-T5 aluminum alloy with 3/4" deep tread rails joined by an TPE hinge and cushion to compromise the overall grid length (traffic direction). The hinge shall be complete with perforations between each tread rail for drainage, unless otherwise specified. Rail finish to be **standard mill finished anodized aluminum**. Unit must withstand 1000 lb. wheel loads (load applied to a 5" x 2" wide polyurethane wheel, 1000 passes without damage).

2.04 MAT FRAMES

- A. LB - Level Base Frame shall be a 1" (25.4mm) deep recessed frame in 6063-T6 aluminum alloy with a 1/4" (6.4mm) wide exposed surface. Black TPE filler trims shall be furnished as required, when standard 1 1/2" (38.1mm) tread spacing cannot be maintained. Installer shall use recommended latex screed to ensure level base. Frame shall be **standard mill finished anodized aluminum** as offered by manufacturer.
- B. Entrance floor mats shall have drain and stainless steel strainer at locations indicated on drawings.

2.05 TREAD INSERT OPTIONS

- A. HD – MonoTuft HD™ Carpet shall meet CRI standard for good indoor air quality. Fibers shall include a minimum of 100, 12 mil monofilament fibers per square inch. Available in one of 19 standard colors as offered by manufacturer. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Anti-static carpet fibers shall contain antimicrobial additive and be treated with Scotchgard® to reduce soiling. Carpet weight shall be 33-oz./yd².

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped mat/grid assemblies to ensure a proper installation.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations.
- B. Set mat/grid at height recommended by manufacturer for most effective cleaning action.
- C. Coordinate top of mat/grid surfaces with bottom of doors that swing across to provide ample clearance between door and mat/grid.

3.04 CLEANING

- A. It is important to the life cycle of the entrance mat that a maintenance schedule be developed which includes regular vacuuming and extraction that correctly matches the amount of traffic the mat incurs.

3.05 PROTECTION

- A. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.
- B. Defer installation of floor mats/grids until time of substantial completion of project.

END OF SECTION

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes:

1. Motors.
2. Sleeves without waterstop.
3. Sleeves with waterstop.
4. Stack-sleeve fittings.
5. Sleeve-seal systems.
6. Grout.
7. Silicone sealants.
8. Escutcheons.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of specified product, excluding motors which are included in Part 1 of the fire-suppression equipment Sections.
 - a. Include construction details, material descriptions, and dimensions of components.
 - b. Include operating characteristics and furnished accessories.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

PART 2 - PRODUCTS

2.1 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

3. Steel Sheet Sleeves: ASTM A653/A653M, **24 gauge** minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
4. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
5. Molded-PVC Sleeves: With nailing flange.
6. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.

B. Sleeves with Waterstop:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, LLC
 - b. CALPICO, Inc.
 - c. GPT Industries, LLC.
 - d. Metraflex Company (The)
2. Description: Manufactured PVC/HDPE, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Sleeve-Seal Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, LLC
 - b. CALPICO, Inc.
 - c. GPT Industries, LLC.
 - d. Metraflex Company (The)
 - e. Proco Products, Inc
2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - a. Hydrostatic Seal: **20 psig** minimum.
 - b. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
 - c. Pressure Plates: Carbon steel.
 - d. Connecting Bolts and Nuts: Carbon steel, with ASTM B633 coating of length required to secure pressure plates to sealing elements.

D. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: **5000 psi**, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

E. Silicone Sealants:

1. Silicone Sealant, S, P, T, NT: Single-component, 25, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
 - 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) Pecora Corporation
 - 2) Sika Corporation
 - 3) The Dow Chemical Company
 - 4) Tremco Incorporated
 - b. Standard: ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
2. Verify sealant has a VOC content of 250 g/L or less.
3. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.2 ESCUTCHEONS

- 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. BrassCraft Manufacturing Co.; a Masco company
 2. Dearborn Brass
 3. Jones Stephens Corp.
 4. Keeney Manufacturing Company (The)
 5. Mid-America Fittings, LLC; A Midland Industries Company
 6. ProFlo; a Ferguson Enterprises, Inc. brand
- B. Escutcheon Types:
1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
 2. One-Piece, Stainless-steel Type: With polished stainless-steel finish.
 3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
 5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
 6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.
- C. Floor Plates:
1. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE LOOPS AND SWING CONNECTIONS

- A. Install pipe loops and offsets in accordance with NFPA 13 requirements for expansion and contraction compensation.

3.2 INSTALLATION OF SLEEVES, GENERAL

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire-resistance of floor/slab/wall.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.3 INSTALLATION OF SLEEVES WITH WATERSTOP

- A. Install sleeve with waterstop as new walls and slabs are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width centered in concrete slab or wall.
- C. Secure nailing flanges to wooden concrete forms.
- D. Using grout or silicone sealant, seal space around outside of sleeves.

3.4 INSTALLATION OF STACK-SLEEVE FITTINGS

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 1. Install fittings that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 3. Install section of cast-iron soil pipe to extend sleeve to **3 inches** above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.6 INSTALLATION OF ESCUTCHEONS

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.7 FIELD QUALITY CONTROL

- A. Sleeves and Sleeve Seals:
 - 1. Perform the following tests and inspections:
 - a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
 - b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
 - 2. Prepare test and inspection reports.
- B. Escutcheons:
 - 1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.8 SLEEVES APPLICATION

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above and below Grade:
 - a. Sleeves with waterstops.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Concrete Slabs-on-Grade:
 - a. Sleeves with waterstops.

- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:
 - a. Sleeves with waterstops or stack-sleeve fittings.
4. Interior Walls and Partitions:
 - a. Sleeves without waterstops.

3.9 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel, cast brass or split plate steel with polished, chrome-plated finish.
3. Insulated Piping:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One-piece, stainless-steel with polished stainless-steel finish.
 - c. One piece, cast brass with polished, chrome-plated finish.
 - d. One piece, stamped steel or split plate, stamped steel with concealed hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One-piece, stainless-steel with polished stainless-steel finish.
 - c. One piece, cast brass with polished, chrome-plated finish.
 - d. One piece, stamped steel or split plate, stamped steel with concealed hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
5. Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stainless-steel with polished stainless-steel finish.
 - c. One piece, cast brass with polished, chrome-plated finish.
 - d. One piece, stamped steel or split plate, stamped steel with concealed hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
6. Bare Piping in Unfinished Service Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, cast brass with polished, chrome-plated finish.
 - c. One piece, stamped steel or split plate, stamped steel with concealed

hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

7. Bare Piping in Equipment Rooms:

- a. One piece, steel with polished, chrome-plated finish.
- b. One piece, cast brass with polished, chrome-plated finish.
- c. One piece, stamped steel or split plate, stamped steel with concealed hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

B. Escutcheons for Existing Piping to Remain:

1. Chrome-Plated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
2. Insulated Piping: Split plate stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One piece, floor plate.
2. Existing Piping: Split floor plate.

END OF SECTION 210500

SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Two-piece ball valves with indicators.
 - 2. Bronze butterfly valves with indicators.
 - 3. Iron butterfly valves with indicators.
 - 4. Check valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
 - 1. Fire Main Equipment: HAMV - Main Level.
 - a. Indicator Posts, Gate Valve: HCBZ - Level 1.
 - b. Ball Valves, System Control: HLUG - Level 3.
 - c. Butterfly Valves: HLXS - Level 3.
 - d. Check Valves: HMER - Level 3.
 - e. Gate Valves: HMRZ - Level 3.
 - 2. Sprinkler System and Water Spray System Devices: VDGT - Main Level.
 - a. Valves, Trim and Drain: VQGU - Level 1.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
 - 1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.

- 2) Check valves.
- 3) Miscellaneous valves.

C. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B31.9 for building services piping valves.

D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

E. NFPA Compliance for Valves:

1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.

F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves **NPS 2** and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

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. Ames Fire & Waterworks; A Watts Water Technologies Company
2. NIBCO INC.
3. Victaulic Company

B. Description:

1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: **175 psig**.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless-steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear
10. Supervisory Switch: Internal or external.

11. End Connections for Valves **NPS 1** through **NPS 2**: Threaded ends.
12. End Connections for Valves **NPS 2-1/2**: Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

- 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. ALEUM USA
 2. Globe Fire Sprinkler Corporation
 3. Milwaukee Valve Company
- B. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
 2. Minimum: Pressure rating: **175 psig**.
 3. Body Material: Bronze.
 4. Seat Material: EPDM.
 5. Stem Material: Bronze or stainless-steel.
 6. Disc: Bronze with EPDM coating.
 7. Actuator: Worm gear.
 8. Supervisory Switch: Internal or external.
 9. Ends Connections for Valves **NPS 1** through **NPS 2**: Threaded ends.
 10. Ends Connections for Valves **NPS 2-1/2**: Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

- 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. ALEUM USA
 2. Anvil; an ASC Engineered Solution
 3. Globe Fire Sprinkler Corporation
 4. Kennedy Valve Company; a division of McWane, Inc.
 5. NIBCO INC.
 6. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 7. Victaulic Company
 8. Wilkins; Zurn Elkay
 9. Zurn; Zurn Elkay
- B. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.

2. Minimum Pressure Rating: **175 psig**.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless-steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear.

8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer.

2.5 CHECK VALVES

- 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. ALEUM USA
2. Ames Fire & Waterworks; A Watts Water Technologies Company
3. Anvil; an ASC Engineered Solution
4. FEBCO; A WATTS Brand
5. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International
6. Globe Fire Sprinkler Corporation
7. Kennedy Valve Company; a division of McWane, Inc.
8. Matco-Norca
9. Mueller Co. LLC; Mueller Water Products, Inc.
10. NIBCO INC.
11. Reliable Automatic Sprinkler Co., Inc. (The)
12. Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
13. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
14. United Brass Works, Inc
15. Venus Fire Protection Ltd.
16. Victaulic Company
17. Viking Group Inc.
18. WATTS; A Watts Water Technologies Company
19. Wilkins; Zurn Elkay
20. Wilson & Cousins Inc.
21. Zurn; Zurn Elkay

- B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: **175 psig**.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless-steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless-steel.

7. Hinge Shaft: Bronze or stainless-steel.
8. Hinge Spring: Stainless-steel.
9. End Connections: Flanged, grooved, or threaded.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
 1. Section 211000 "Water-Based Fire-Suppression Systems" for application of valves in fire-suppression standpipes; wet-pipe, fire-suppression sprinkler systems; and dry-pipe, fire-suppression sprinkler systems.
 2. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.
 3. Section 331415 "Site Water Distribution Piping" for application of valves in fire-suppression water-service piping.
- 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 double-check valve assembly in each fire-protection water-supply connection.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 210523

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports for fire-suppression piping - metal.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Pipe hangers - metal trapeze type.
2. Equipment supports.

C. Delegated Design Submittals: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding Certificates: For structural-steel and pipe welding.

B. Delegated Design Engineer Qualifications: For trapeze hangers.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

- B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2025 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.
- C. NFPA Compliance: Comply with NFPA 13.
- D. UL Compliance: Comply with UL 203.

2.2 PIPE HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING - METAL

- A. Pipe Hangers and Supports for Fire-Suppression Piping - Carbon Steel:
 - 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. Anvil; an ASC Engineered Solution
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. FNW; Ferguson Enterprises, Inc.
 - 2. Description: Factory-fabricated components, NFPA approved, UL listed, or FM Global approved for fire-suppression piping support.
 - 3. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
 - 4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Pipe/Tube Hangers and Supports for Fire-Suppression Piping - Copper:
 - 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. Anvil; an ASC Engineered Solution
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. FNW; Ferguson Enterprises, Inc.
2. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM Global approved for fire-suppression piping support.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 MATERIALS

- A. Aluminum: **ASTM B221**.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; black and galvanized.
- D. Stainless-steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: **5000 psi**, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION OF HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

- A. Comply with requirements in Section 078400 "Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to comply with NFPA 13 requirements, minimum 5 times the water-filled weight of piping and supported components plus 250 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

- A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- B. Install lateral bracing with pipe hangers and supports to prevent swaying.

- C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Coordinate location of concrete inserts before concrete is placed.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Hangers and Supports - Metal: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- G. Thermal Hanger Shield Inserts: Install in pipe hanger or shield for insulated piping.
- H. Fastener Systems:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than **4 inches** thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners in accordance with powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners in accordance with manufacturer's written instructions. Install in accordance with approvals and listings.
- I. Hangers and Supports, General: Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Supports:
 - 1. Fabricate from welded-structural-steel shapes.
 - 2. Grouting: Place grout under supports for floor-mounted equipment and make bearing surface smooth.
 - 3. Provide lateral bracing, to prevent swaying.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier

- is indicated. Fill interior voids with insulation that matches adjoining insulation.
- a. MSS SP-58, Type 39 Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe **NPS 4** and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.
 - a. MSS SP-58, Type 40 Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe **NPS 4** and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): **12 inches** long and **0.048 inch** thick.
 - b. NPS 4 (DN 100): **12 inches** long and **0.06 inch** thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): **18 inches** long and **0.06 inch** thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): **24 inches** long and **0.075 inch** thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): **24 inches** long and **0.105 inch** thick.
 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use thermal hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes **NPS 1/2 to NPS 30**.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of **NPS 1/2 to NPS 24** if little or no insulation is required.
 - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 8**.
 - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 3**.
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes **NPS 1/2 to NPS 30**.
 - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes **NPS 4 to NPS 36**, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate.
 - 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes **NPS 4 to NPS 36**, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
 - 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes **NPS 2-1/2 to NPS 36** if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers **NPS 3/4 to NPS 24**.
 - 2. Carbon Steel or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers **NPS 3/4 to NPS 24** if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Comply with NFPA requirements.
- L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. C-Clamps (MSS Type 23): For structural shapes.
 - 3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

SECTION 210548.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vibration isolation pads and mounts.
2. Restraint devices.
3. Post-installed concrete anchors.

B. Related Requirements:

1. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design wind criteria for nonstructural components.
2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
3. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Include load rating for each wind-load-restraint device.
3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and wind-load-restraint component.
4. Annotate to indicate application of each product submitted and compliance with requirements.
5. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of vibration isolation equipment bases including anchorages and attachments to structure and supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Show coordination of wind-load restraints for components with other systems and equipment in the vicinity including other supports.

C. Delegated Design Submittals:

1. Qualified Professional Engineer: All delegated design and submittals for wind-load restraints must be signed and sealed by a qualified professional structural engineer responsible for their preparation. Structural engineer is to possess qualifications specified in Section 014000 "Quality Requirements," with expertise in structural engineering, including design of wind-load restraints, equipment hangers and supports, and concrete attachments.
2. For each vibration isolation device that is required by this Section or is indicated on Drawings, submit the following:
 - a. Vibration Isolator Selection: Select vibration isolators complying with performance requirements, design criteria, and analysis data.
 - b. Vibration Isolation Device Design Calculations: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
 - c. Coordinate vibration isolation details with wind-load restraint details required for equipment mounted outdoors. Also comply with requirements in other Sections for equipment mounted outdoors.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.
4. For each wind-load-restraint device that is required by this Section or is indicated on Drawings, submit the following:
 - a. Wind-Load Restraints: Select and submit wind-load restraints complying with performance requirements, design criteria, and analysis data.
 - b. Pipe Riser Resilient Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 - c. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated wind loads.
 - d. Wind-Load-Restraint Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
5. Wind-Load-Restraint Detail Drawings: Submit the following.
 - a. Design Analysis: To support selection and arrangement of wind-load restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during wind events. Indicate association with vibration isolation devices.
 - c. Coordinate wind-load restraint details required for equipment mounted

outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

6. Product Listing, Preapproval, and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation and wind-load reinforcement device installation for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.
- B. Welding Certificates: For specified shop or field welding.
- C. Field Quality Control Reports: For specified tests and inspections.
- D. Qualification Statements: For professional engineering testing agency and factory-authorized service representative.
 1. See Section 014000 "Quality Requirements" for qualification requirements.
- E. Delegated Design Professional Qualifications: For wind-load restraint design.
- F. High-Wind Qualification Certification: Provide special certification for fire-suppression system components subject to high-wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-load performance certification.
 1. Provide equipment manufacturers' written certification for each designated fire-suppression system device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
 2. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.
 3. The following fire-suppression systems and components require special certification for high-wind performance. Written special certification of resistance to the effects of high-wind load and impact damage must be provided by manufacturer.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Delegated Design Professional Qualifications: A professional engineer who is legally qualified to practice in Florida where Project is located and who is experienced in providing engineering services of the type indicated.

- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to prepare wind-load-restraint calculations and restraint devices selections in accordance with criteria specified in Section 018123 "Facility Seismic and Wind Criteria."
- B. Wind-Load Restraint-Device Ratings: Devices are to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices are to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing.
 - 1. Wind-Load-Restraint Performance: Equipment must be designed and secured to withstand effects of high-wind events. See Section 018123 "Facility Seismic and Wind Criteria" for wind criteria for nonstructural components. See Drawings for identification of equipment required to be wind-load braced.
- C. Consequential Damage: Provide additional restraints for suspended fire-suppression system components or anchorage of floor-, roof-, or wall-mounted fire-suppression system components so that failure of a nonessential or essential fire-suppression system component will not cause the failure of any other essential building component.
- D. Fire/Smoke Resistance: All devices and components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of codes and authorities having jurisdiction. See Section 018123 "Facility Seismic and Wind Criteria" for basis-of-design criteria.

2.2 VIBRATION ISOLATION PADS AND MOUNTS

- A. Elastomeric Vibration Isolation Pad:
 - 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. Ace Mountings Co., Inc.
 - b. Amber Booth; a brand of VMC Group
 - c. B-Line; a brand of Eaton
 - d. CADDY; brand of nVent Electrical plc
 - e. California Dynamics Corporation
 - f. CanFab; a brand of VMC Group
 - g. Kinetics Noise Control, Inc
 - h. Korfund
 - i. Mason Industries, Inc.
 - j. NOVIA; a division of Carpenter & Paterson
 - k. Vibration Eliminator Co., Inc
 - l. Vibration Isolation
 - m. Vibration Management Corp.
2. Source Limitations: Obtain elastomeric vibration isolation pads from single manufacturer.
 3. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 4. Size: Factory or field cut to match requirements of supported equipment.
 5. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
 6. Surface Pattern: Smooth, ribbed, or waffle pattern.
 7. Infused nonwoven cotton or synthetic fibers.
 8. Load-bearing metal plates adhered to pads.
 9. Sandwich-Core Material: Resilient and elastomeric.
 - a. Surface Pattern: Smooth, ribbed, or waffle pattern.
 - b. Infused nonwoven cotton or synthetic fibers.
 10. Minimum deflection as indicated on Drawings.

B. Elastomeric Vibration Isolation Mount:

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. Ace Mountings Co., Inc.
 - b. Amber Booth; a brand of VMC Group
 - c. B-Line; a brand of Eaton
 - d. CADDY; brand of nVent Electrical plc
 - e. California Dynamics Corporation
 - f. CanFab; a brand of VMC Group
 - g. Kinetics Noise Control, Inc
 - h. Korfund
 - i. Mason Industries, Inc.
 - j. NOVIA; a division of Carpenter & Paterson

- k. TOLCO Incorporated
 - l. Vibration Eliminator Co., Inc
 - m. Vibration Isolation
 - n. Vibration Management Corp.
- 2. Source Limitations: Obtain elastomeric vibration isolation mounts from single manufacturer.
 - 3. Type: Single deflection.
 - 4. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
 - 5. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.
 - 6. Minimum deflection as indicated on Drawings.

2.3 RESTRAINT DEVICES

A. Snubber:

- 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. Amber Booth; a brand of VMC Group
 - b. CADDY; brand of nVent Electrical plc
 - c. CanFab; a brand of VMC Group
 - d. Kinetics Noise Control, Inc
 - e. Korfund
 - f. Mason Industries, Inc.
 - g. Vibration Eliminator Co., Inc
 - h. Vibration Management Corp.
 - i.
- 2. Source Limitations: Obtain snubbers from single manufacturer.
- 3. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
- 4. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be designated in accordance with applicable codes. See Section 018213 "Facility Seismic and Wind Criteria" for basis-of-design criteria.
- 5. Preset Concrete Inserts: In accordance with ICC-ES AC446 testing.
- 6. Anchors in Masonry: Design in accordance with TMS 402.
- 7. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
- 8. Resilient Cushion: Maximum **1/4-inch** air gap, and minimum **1/4 inch** thick.

B. Restraint, Rigid Type:

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. Atkore Unistrut
 - b. CADDY; brand of nVent Electrical plc
 - c. California Dynamics Corporation
 - d. Hilti, Inc.
 - e. Simpson Strong-Tie Co., Inc.
 - f. TOLCO Incorporated
2. Source Limitations: Obtain rigid-type restraints from single manufacturer.
3. Description: Shop- or field-fabricated bracing assembly made of AISI S400 slotted steel channels, ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolt:

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. Atkore Unistrut
 - b. B-Line; a brand of Eaton
 - c. CADDY; brand of nVent Electrical plc
 - d. Gripple Inc.
 - e. Hilti, Inc.
 - f. Powers Fasteners
 - g. Simpson Strong-Tie Co., Inc.
 - h. TOLCO Incorporated
2. Source Limitations: Obtain mechanical anchor bolts from single manufacturer.
3. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless-steel for exterior applications. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

B. Expansion-type anchor bolts are not permitted for equipment in excess of **10 hp** that is not vibration isolated.

1. Undercut expansion anchors are permitted.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to high wind forces.
- C. Strength of Support and Restraint Assemblies: Where not otherwise specifically indicated, select sizes of components so strength is adequate to carry static and wind-load forces within specified loading limits.

3.2 INSTALLATION OF VIBRATION-ISOLATION FOR FIRE SUPPRESSION

- A. Provide vibration-isolation devices for systems and equipment where indicated in Equipment Schedules or Fire-Suppression Vibration Isolator Schedules on Drawings, where Specification indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- C. Installation of vibration isolators must not cause any change of position of equipment or piping resulting in stresses or misalignment.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

3.3 INSTALLATION OF RESTRAINT DEVICES

- A. Provide wind-load restraint devices for systems and equipment where indicated in Equipment Schedules or Wind-Load Restraint Device Schedule, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Installation of wind-load restraint devices must not cause any change in position of equipment or piping resulting in stresses or misalignment.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and

formwork specified in Section 033000 "Cast-in-Place Concrete."

D. Equipment Restraints:

1. Snubbers: Install snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inch**.
3. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

E. Piping Restraints:

1. Comply with all requirements in NFPA 13.
2. Design piping sway bracing in accordance with NFPA 13.
 - a. Maximum spacing of all sway bracing to be no greater than indicated in NFPA 13.
 - b. Design loading of all sway bracing not to exceed values indicated in NFPA 13.

F. Install wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.

G. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.4 INSTALLATION OF POST-INSTALLED CONCRETE ANCHORS

- A. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas and water lines.
- B. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- C. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors are to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- D. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in 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.

- E. Set anchors to manufacturer's recommended torque, using a torque wrench.
- F. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at no fewer than four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
- E. Remove and replace malfunctioning units and retest as specified above.
 - 1. Units will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 210548.13

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Warning tags.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve-Numbering Scheme: For fire-suppression piping system.
- E. Valve Schedules: For fire-suppression piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 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. Brady Corporation
 - b. Carlton Industries, LP
 - c. Champion America
 - d. Craftmark Pipe Markers
 - e. emedco
 - f. Kolbi Pipe Marker Co.

- g. LEM Products Inc.
 - h. Marking Services Inc.
 - i. Pipemarker.com; Brimar Industries, Inc.
 - j. Seton Identification Products; a Brady Corporation company
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 - 3. Letter and Background Color: As indicated for specific application under Part 3.
 - 4. Maximum Temperature: Able to withstand temperatures of up to **160 deg F**.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch**.
 - 6. Minimum Letter Size: **1/4 inch** for name of units if viewing distance is less than **24 inches**, **1/2 inch** for viewing distances of up to **72 inches**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. Warning Sign and Label:
- 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. Brady Corporation
 - b. Carlton Industries, LP
 - c. Champion America
 - d. Craftmark Pipe Markers
 - e. emedco
 - f. LEM Products Inc.
 - g. Marking Services Inc.
 - h. National Marker Company
 - i. Pipemarker.com; Brimar Industries, Inc.
 - j. Seton Identification Products; a Brady Corporation company
 - k. Stranco, Inc.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 - 3. Letter and Background Color: As indicated for specific application under Part 3.
 - 4. Maximum Temperature: Able to withstand temperatures of up to **160 deg F**.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch**.
 - 6. Minimum Letter Size: **1/4 inch** for name of units if viewing distance is less than

- 24 inches, 1/2 inch** for viewing distances of up to **72 inches**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.
 10. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Pipe Label:

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. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - b. Brady Corporation
 - c. Carlton Industries, LP
 - d. Champion America
 - e. Craftmark Pipe Markers
 - f. emedco
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Pipemarker.com; Brimar Industries, Inc.
 - k. Seton Identification Products; a Brady Corporation company
2. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
5. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
6. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include the following:
 - a. Pipe size.
 - b. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - c. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.4 WARNING TAGS

A. Warning Tag:

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. Brady Corporation
 - b. Champion America
 - c. Craftmark Pipe Markers
 - d. emedco
 - e. Kolbi Pipe Marker Co.
 - f. LEM Products Inc.
 - g. Marking Services Inc.
 - h. Pipemarker.com; Brimar Industries, Inc.
 - i. Seton Identification Products; a Brady Corporation company
2. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized cardstock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches minimum.
 - b. Fasteners: Brass grommet and wire.
 - c. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - d. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.2 INSTALLATION OF EQUIPMENT LABELS

- A. Permanently fasten labels on each item of fire-suppression equipment.
- B. Equipment Label Colors:
 1. White letters on an ANSI Z535.1 safety-red background.

- C. Locate equipment labels where accessible and visible.

3.3 INSTALLATION OF WARNING SIGNS AND LABELS

- A. Permanently fasten labels on each item of fire-suppression equipment.
- B. Warning Sign and Label Colors: In accordance with requirements of OSHA and other applicable codes and standards.
 - 1. Black letters on an ANSI Z535.1 safety-yellow background.
- C. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF PIPE LABELS

- A. Piping Color Coding: Painting of piping is specified in Section 099600 "High-Performance Coatings."
- B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within **3 ft.** of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit a view of concealed piping.
 - 3. Within **3 ft.** of equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
- D. Flow- Direction Arrows: Provide arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Fire-Suppression Pipe Label Color Schedule:
 - 1. Fire-Suppression Pipe Labels: White letters on an ANSI Z535.1 safety-red background.

3.5 INSTALLATION OF WARNING TAGS

- A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
- B. Attach warning tags, with proper message, to equipment and other items where scheduled.

END OF SECTION 210553

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-suppression piping, fittings, and appurtenances.
2. Fire department connections.
3. System control valves.
4. Fire-suppression piping specialties.
5. Sprinklers.
6. Alarm devices.
7. Manual control stations.
8. Control panels.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for site fire-suppression water-service and backflow prevention devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include construction details, material descriptions, dimensions of individual components and profiles.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Prepare in accordance with NFPA 13 and NFPA 14 section "Working Plans."
 - a. Include plans, elevations, and sections of the system piping and details.
 - b. Include detailed riser diagram and schematic diagram showing system supply, supply connection, devices, valves, pipe and fittings, as well as the delineation of the standard-pressure and high-pressure portions of the fire-suppression system.
 - c. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Prepare computer-generated hydraulic calculations in accordance with the following:

- a. Minimum operating pressure at hydraulically most remote fire hose valve is to be 100 psig.
 - b. Name of hydraulic program used.
 - c. Water supply information, including fire hydrant flow test data report.
3. Submit documents and calculations signed and sealed by qualified professional engineer responsible for their preparation and prepared by NICET Level III-certified technician, "Water-Based Systems Layout."
4. Include diagrams for power, signal, and control wiring.
- C. Delegated Design Submittals: For fire-suppression systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Sustainable Design Submittals:
 1. Product Data: For adhesives, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Fire-suppression system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Seismic Qualification Certificates: For fire-suppression equipment, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Qualification Data: For qualified Installer and professional engineer and NICET-certified technician.
- D. Design Data: Approved fire-suppression piping working plans, prepared in accordance with NFPA 13 and NFPA 14, including documented approval by AHJs, and including hydraulic calculations if applicable.
- E. Welding certificates.
- F. Field Test Reports:
 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 2. Fire-hydrant flow test report.

- G. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-suppression systems and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Fire-Suppression Service: Do not interrupt fire-suppression service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression service in accordance with requirements indicated:
 - 1. Notify Owner's Representative no fewer than seven days in advance of proposed interruption of fire-suppression service.
 - 2. Do not proceed with interruption of fire-suppression service without Owner's Representative's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Automatic wet-pipe sprinkler system.
- B. Automatic dry-pipe sprinkler.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Suppression System Components, Devices, and Accessories: Listed in ULSE's "Fire Protection Equipment Directory" and FM Approvals' "Approval Guide."

- 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. Fire-suppression system equipment, specialties, accessories, installation, and testing to comply with NFPA 13, NFPA 14 and ASME A17.1.
- D. Standard-Pressure Piping System Component: Listed for **175 psig** minimum working pressure.
- E. High-Pressure Piping System Component: Listed for 250 psig minimum working pressure.
- F. Delegated Design: Engage a qualified professional engineer to design fire-suppression systems.
 - 1. Fire-Hydrant Flow Test:
 - a. Available fire-hydrant flow test records indicate the following conditions:
 - 1) Date: 2026 Sept 18.
 - 2) Time: 12:30 PM.
 - 3) Performed by: Genesis Fire Services.
 - 4) Location of Residual Fire Hydrant R: closest to gym.
 - 5) Location of Flow Fire Hydrant F: Front of gym.
 - 6) Static Pressure at Residual Fire Hydrant R: 69 psig.
 - 7) Measured Flow at Flow Fire Hydrant F: 787 gpm.
 - 8) Residual Pressure at Residual Fire Hydrant R: 38 psig.
 - b. Fire-hydrant flow test must be performed within previous 6 months prior to completion of design documents and hydraulic calculations.
 - 2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 3. Sprinkler Occupancy Hazard Classifications:
 - a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - b. General Storage Areas: Ordinary Hazard, Group 1.
 - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. Mercantile: Ordinary Hazard, Group 2.
 - e. Offices, including Data Processing: Light Hazard.
 - f. Theaters and Auditoriums, excluding Stages and Prosceniums: Light Hazard.
 - g. Gymnasiums: Light Hazard.
 - 4. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1500 sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft.

- area.
- d. Special Occupancy Hazard: As determined by AHJs.
- 5. Maximum protection area per sprinkler in accordance with ULSE listing.
- 6. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 120 sq. ft..
 - b. Storage Areas: 130 sq. ft..
 - c. Mechanical Equipment Rooms: 130 sq. ft..
 - d. Electrical Equipment Rooms: 130 sq. ft..
 - e. Other Areas: In accordance with NFPA 13 recommendations unless otherwise indicated.
- 7. Total Combined Hose-Stream Demand Requirement: In accordance with NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- G. Obtain documented approval of fire-suppression system design from AHJs.

2.3 FIRE-SUPPRESSION PIPING, FITTINGS, AND APPURTENANCES

- A. Steel Pipe, Fittings, and Appurtenances:
 - 1. Schedule 40 Steel Pipe: Galvanized- and black- steel pipe, ASTM A53/A53M, ASTM A135/A135M, or ASTM A795/A795M.
 - a. Standards:
 - 1) UL 852.
 - 2) FM 1630.
 - b. Factory-applied exterior coating.
 - c. Factory-applied bacterial-resistant internal coating to reduce microbiologically influenced corrosion.
 - d. Pipe ends may be factory or field formed to match joining method.
 - 2. Schedule 10 Steel Pipe: Galvanized- and black- steel pipe, ASTM A53/A53M, ASTM A135/A135M, or ASTM A795/A795M.
 - a. Standards:
 - 1) UL 852.
 - 2) FM 1630.
 - b. Factory-applied exterior coating.
 - c. Factory-applied bacterial resistant internal coating to reduce microbiologically influenced corrosion.
 - d. Pipe ends may be factory or field formed to match joining method.

3. Engineered Light-Wall Steel Pipe: Galvanized- and black- steel pipe, ASTM A135/A135M or ASTM A795/A795M with wall thickness less than Schedule 40. Outside dimension is to be equivalent to Schedule 40.
 - a. Standards:
 - 1) UL 852.
 - 2) FM 1630.
 - b. Factory-applied exterior coating.
 - c. Factory-applied bacterial-resistant internal coating to reduce microbiologically influenced corrosion.
 - d. Pipe ends may be factory or field formed to match joining method.
4. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
5. Steel Couplings: Galvanized and uncoated steel, ASTM A865/A865M, threaded.
6. Gray-Iron Threaded Fittings: Galvanized and uncoated gray-iron threaded fittings, ASME B16.4, Class 125, standard pattern.
7. Malleable- or Ductile-Iron Unions: ASME B16.3.
8. Cast-Iron Flanges: ASME B16.1, Class 125.
9. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 - a. Pipe-Flange Gasket Materials: **AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.**
 - 1) Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - 2) Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 - b. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1 carbon steel unless otherwise indicated.
10. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
 - a. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
11. Plain-End-Pipe Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Gruvlok; an ASC Engineered Solution
 - 2) Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
 - 3) Victaulic Company
- b. Pressure Rating: 175 psig minimum.
 - c. Plain-End Fittings for Steel Piping: Galvanized plain-end fittings, ASTM A53/A53M, carbon steel or ASTM A106/A106M, forged steel with dimensions matching steel pipe.
 - d. Plain-End-Pipe Couplings for Steel Piping: Rigid pattern for steel-pipe dimensions, ductile-iron or malleable-iron housing. Include EPDM-rubber gasket, and bolts and nuts.

12. Grooved-Joint, Steel-Pipe Appurtenances:

- 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) CPS Products, Inc.
 - 2) Gruvlok; an ASC Engineered Solution
 - 3) SCI; an ASC Engineered Solution
 - 4) Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
 - 5) SPF/Anvil; an ASC Engineered Solution
 - 6) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - 7) Victaulic Company
- b. Pressure Rating: 175 psig minimum.
- c. Grooved-End Fittings for Steel Piping: Galvanized grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
- d. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

B. Stainless-steel Pipe, Fittings, and Appurtenances:

1. Stainless-steel Pipe: ASTM A312/A312M, Type 304/304L, Schedule 10S, dimensions conforming to ASME B36.19M.
2. Stainless-steel Pipe Fittings: ASTM A403/A403M.
3. Fittings for Grooved-End, Stainless-steel Pipe:
 - 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) GroovJoint

- b. Source Limitations: Obtain appurtenance for grooved-end, stainless-steel pipe from single manufacturer.
 - c. Standards: ASTM A743; ASTM A193/A193M, Class 2; and ASTM A194/A194M, Type 304, Grade 8M.
 - d. Fittings for Grooved-End, Stainless-steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
4. Mechanical Couplings for Grooved-End, Stainless-steel Pipe:
- 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) GroovJoint
 - b. AWWA C606 for stainless-steel pipe dimensions.
 - c. Stainless-steel housing sections.
 - d. Stainless-steel bolts and nuts.
 - e. EPDM-rubber gaskets suitable for hot and cold water.
 - f. Minimum Pressure Rating:
 - 1) NPS 8 (DN 200) and Smaller: 600 psig.
 - 2) NPS 10 and NPS 12 (DN 250 to DN 300): 400 psig.
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600): 250 psig.

C. Copper Tube, Fittings, and Appurtenances:

- 1. Copper Tube, Drawn Temper: ASTM B88, Type K, ASTM B88, Type L and ASTM B88, Type M.
- 2. Solder-Joint Fittings, Cast Copper: ASME B16.18 pressure fittings.
- 3. Solder-Joint Fittings, Wrought Copper: ASME B16.22 pressure fittings.
- 4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- 5. Unions, Cast Copper: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- 6. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- 7. Copper-Tube, Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Viega LLC
 - b. Fittings: Cast brass, cast bronze, or wrought copper with EPDM O-ring seal

- in each end.
- c. Minimum **200 psig** working-pressure rating at **250 deg F**.

D. CPVC Pipe, Fittings, and Appurtenances:

1. CPVC Pipe: ASTM F442/F442M and UL 1821, SDR 13.5, for **175 psig** rated pressure at **150 deg F**, with plain ends. Include "LISTED" and "CPVC SPRINKLER PIPE" markings.
2. CPVC Fittings: UL listed or FM Approvals approved, for **175 psig** rated pressure at **150 deg F**, socket type. Include "LISTED" and "CPVC SPRINKLER FITTING" markings.
 - a. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): ASTM F438 and UL 1821, Schedule 40, socket type.
 - b. NPS 2 to NPS 3 (DN 50 to DN 80): ASTM F439 and UL 1821, Schedule 80, socket type.
 - c. CPVC-to-Metal Transition Fittings: CPVC, one piece, with dimensions equivalent to pipe; one end with threaded brass insert, and one socket end.
 - d. CPVC-to-Metal Transition Unions: CPVC, with dimensions equivalent to pipe; one end with threaded brass insert, and one socket end.
 - e. Flanges: CPVC, one or two pieces.
3. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493 solvent cement recommended by pipe and fitting manufacturer, and made for joining CPVC sprinkler pipe and fittings. Include cleaner or primer recommended by pipe and fitting manufacturer.
 - a. Verify adhesive primer has a VOC content of 550 g/L or less.
 - b. Verify adhesive primer complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - c. Verify CPVC welding solvent cement has a VOC content of 490 g/L or less.
 - d. Verify solvent cement complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. Plastic Pipe-Flange Gasket and Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connection, Exposed Type:

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. Croker; a Division of Morris Group International
 - b. Elkhart Brass Mfg. Co., Inc
 - c. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International
 - d. Guardian Fire Equipment, Inc
 - e. Potter Roemer LLC; a Division of Morris Group International
 - f. Wilson & Cousins Inc.
2. Standard: UL 405.
3. Description: Exposed, projecting, for wall mounting.
4. Pressure Rating: **175 psig** minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads in accordance with NFPA 1963 and matching local fire department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Number of Inlets: Two.
11. Escutcheon Plate Marking: "AUTO SPKR".
12. Finish: Polished chrome plated.
13. Outlet Size: NPS 4.

2.5 SYSTEM CONTROL VALVES

- A. Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
- B. Pressure Rating:
 1. Standard-Pressure Piping Valves: **175 psig** minimum.
 2. High-Pressure Piping Valves: 250 psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. System Control Valve, Alarm Valve:
 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. Reliable Automatic Sprinkler Co., Inc. (The)
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - c. Venus Fire Protection Ltd.
 - d. Victaulic Company
 - e. Viking Group Inc.
2. Standard: UL 193.
 3. Design: For horizontal or vertical installation.
 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
 5. Drip cup assembly pipe drain without valves and separate from main drain piping with check valve to main drain piping.

2.6 FIRE-SUPPRESSION PIPING SPECIALTIES

A. Branch Outlet Fittings:

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. Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - c. Victaulic Company
2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

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. AGF Manufacturing, Inc.
 - b. Reliable Automatic Sprinkler Co., Inc. (The)

- c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - d. Victaulic Company
 - 2. Standard: ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded or grooved.
- C. Sprinkler Inspector's Test Fittings:
- 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. AGF Manufacturing, Inc.
 - b. Reliable Automatic Sprinkler Co., Inc. (The)
 - c. Viking Group Inc.
 - 2. Standard: ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with sight glass.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- D. Flexible Sprinkler Hose Fittings:
- 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. ALEUM USA
 - b. Easyflex, Inc.
 - c. Flexhead; an ASC Engineered Solution
 - d. Gateway Tubing, Inc.
 - e. Reliable Automatic Sprinkler Co., Inc. (The)
 - f. Victaulic Company
 - 2. Standards:
 - a. UL 2443.
 - b. FM 1637.
 - 3. Description: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - 4. Pressure Rating: 175 psig minimum.
 - 5. Size: Same as connected piping, for sprinkler.

E. Pressure-Reducing Valves:

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. CLA-VAL
 - b. Croker; a Division of Morris Group International
 - c. Elkhart Brass Mfg. Co., Inc
 - d. Guardian Fire Equipment, Inc
 - e. OCV Control Valves
 - f. Potter Roemer LLC; a Division of Morris Group International
 - g. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - h. Victaulic Company
 - i. Wilkins; Zurn Elkay
 - j. Wilson & Cousins Inc.
 - k. Zurn; Zurn Elkay
2. UL 668 hose valve, with integral UL 1468 reducing device.
3. Pressure Rating: **300-psig** minimum.
4. Material: Brass or bronze.
5. Inlet: Female pipe threads.
6. Outlet: Threaded with or without adapter having male hose threads.
7. Pattern: Angle or gate.
8. Finish: Polished chrome plated.

F. Automatic (Ball-Drip) Drain Valves:

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. Reliable Automatic Sprinkler Co., Inc. (The)
 - b. Viking Group Inc.
2. Pressure Rating: **175 psig** minimum.
3. Type: Automatic draining, ball check.
4. Size: **NPS 3/4**.
5. End Connections: Threaded.

G. Automatic Air Vent Assembly:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. Engineered Corrosion Solutions
 - c. South-Tek Systems, LLC

2. Description: Automatic air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly. Approved for use in wet-pipe fire-suppression system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: **175 psig**.

2.7 SPRINKLERS

- 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. Reliable Automatic Sprinkler Co., Inc. (The)
 2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 3. Victaulic Company
 4. Viking Group Inc.
- B. Standards:
 1. UL 199.
 2. UL 1626.
 3. UL 1767.
 4. FM 2000.
 5. FM 2008.
 6. FM 2030.
- C. Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
- D. Pressure Rating for Sprinklers:
 1. Standard Automatic Sprinklers: **175 psig** minimum.
 2. High-Pressure Automatic Sprinklers: 250 psig minimum.
 3. Residential Sprinklers: **175 psig** maximum.
- E. Sprinklers, Automatic Wet with Heat-Responsive Element:
 1. Characteristics: 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.
 2. Standard Spray, Standard Response:
 - a. Upright.
 - b. Pendent.
 - c. Recessed pendent.
 - d. Flat, concealed pendent.
 - e. Vertical sidewall.

- f. Horizontal sidewall.
 - 3. Standard Spray, Quick Response:
 - a. Upright.
 - b. Pendent.
 - c. Recessed pendent.
 - d. Flat, concealed pendent.
 - e. Vertical sidewall.
 - f. Horizontal sidewall.
 - g. Flat, concealed horizontal sidewall.
 - 4. Extended Coverage:
 - a. Upright.
 - b. Pendent.
 - c. Flat, concealed pendent.
 - d. Horizontal sidewall.
 - e. Flat, concealed horizontal sidewall.
 - 5. Residential:
 - a. Recessed pendent.
 - b. Flat, concealed pendent.
 - c. Flat, concealed horizontal sidewall.
- F. Sprinklers, Automatic Dry with Heat-Responsive Element:
 - 1. Standard Spray, Standard Response:
 - a. Upright.
 - b. Pendent.
 - c. Recessed pendent.
 - d. Flat, concealed pendent.
 - e. Horizontal sidewall.
 - 2. Standard Spray, Quick Response:
 - a. Upright.
 - b. Pendent.
 - c. Recessed pendent.
 - d. Flat, concealed pendent.
 - e. Horizontal sidewall.
 - f. Flat, concealed horizontal sidewall.
- G. Special Sprinklers:
 - 1. Attic.
 - 2. Combustible, concealed.
 - 3. ESFR.
 - 4. Flat spray.

5. Hallway.
6. Institutional.
7. MRI/Non-Ferrous, concealed.
8. Window.

H. Open Sprinklers and Nozzles:

1. Nominal Orifice:
 - a. **1/2 inch**, with discharge coefficient K between 5.3 and 5.8.
 - b. **17/32 inch** with discharge coefficient K between 7.4 and 8.2.

I. Sprinkler Finishes: Chrome plated bronze and painted.

J. Special Coatings: Wax lead and corrosion-resistant paint.

K. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

L. Sprinkler Guards and Water Shields:

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. Reliable Automatic Sprinkler Co., Inc. (The)
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
 - c. Victaulic Company
 - d. Viking Group Inc.
2. Standard: UL 199.
3. Description: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Match alarm-device material and connection types to piping and equipment materials and connection types.

B. Electrically Operated Notification Appliances:

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. Notifier; Honeywell International, Inc.
 - b. Potter Electric Signal Company, LLC

2. Electric Bell:

- a. Standard: UL 464.
- b. Type: Vibrating, metal alarm bell.
- c. Size: 6-inch minimum- diameter.
- d. Voltage: 120 V ac, 60 Hz, single phase.
- e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.

3. Strobe/Horn:

- a. Standard: UL 464.
- b. Tone: Selectable, steady, Temporal (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
- c. Voltage: 120 V ac, 60 Hz.
- d. Effective Intensity: 110 cd.
- e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
- f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police or fire department.

C. Water-Flow Indicators:

- 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. Potter Electric Signal Company, LLC
 - b. System Sensor; Honeywell International, Inc.
 - c. Viking Group Inc.
- 2. Standard: UL 346.
- 3. Water-Flow Detector: Electrically supervised.
- 4. 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.
- 5. Type: Paddle operated.
- 6. Pressure Rating: **250 psig**.
- 7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Kennedy Valve Company; a division of McWane, Inc.
 - b. Potter Electric Signal Company, LLC
 - c. System Sensor; Honeywell International, Inc.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Design: Signals that controlled valve is in other than fully open position.
5. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on valve and valve is fully open.
6. 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.
7. OS&Y Valve Supervisory Switches:
 - a. One or two single-pole, double-throw switches.
 - b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
 - c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
 - d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
 - e. Trip Rod Length: Adjustable
8. Butterfly Valve Supervisory Switches:
 - a. Two single-pole, double-throw switches.
 - b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
 - c. Mounting Hardware: Removable nipple.
 - d. Trip Rod Length: Adjustable
9. Ball Valve Supervisory Switches:
 - a. One single-pole, double-throw switch.
 - b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
 - c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves, or backflow preventers sized from up to **NPS 2**.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE-SUPPRESSION WATER-SERVICE PIPING

- A. Comply with requirements for fire-suppression water-service piping in Section 331415 "Site Water Distribution Piping."

3.2 INSTALLATION OF DOMESTIC WATER-SUPPLY CONNECTIONS

- A. Connect fire-suppression water piping to building's interior domestic water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 331415 "Site Water Distribution Piping."

3.3 INSTALLATION OF FIRE-SUPPRESSION PIPING

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from AHJs. File written approval with Owner's Representative before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 and NFPA 14 requirements for installation of fire-suppression piping.
- C. Install seismic restraints on piping. Comply with NFPA standards requirements for seismic-restraint device materials and installation.
- D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes **NPS 2** and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having **NPS 2-1/2** and larger end connections.
- G. Install inspector's test connections in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13.
- H. Install fire-suppression system piping with drains for complete system drainage. Extend drain piping to exterior of building where possible.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- 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 exterior of building.
- K. Install alarm devices in piping systems.

- L. Install hangers and supports for fire-suppression piping in accordance with NFPA standards. Comply with requirements for hanger materials in NFPA standards. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe/sprinkler supply. Include pressure gauges with connection not less than **NPS 1/4** and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
- N. Pressurize and check dry-pipe standpipe or sprinkler system piping and air compressors.
- O. Fill wet-type fire-suppression system piping with water.
- P. Drain dry-type fire-suppression system piping.
 - 1. Install electric heating cables and pipe insulation on fire-suppression piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210500 "Common Work Results for Fire-Suppression Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210500 "Common Work Results for Fire-Suppression Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

3.4 INSTALLATION OF PIPING JOINTS

- 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. Install unions adjacent to each valve in pipes **NPS 2** and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having **NPS 2-1/2** and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators in accordance with "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.
- M. Brazed Joints: Join copper tube and fittings in accordance with Copper Development Association's "Copper Tube Handbook," "Brazed Joints" chapter.
- N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.
- O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
- P. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

- R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join in accordance with ASTM D2846/D2846M Appendix.

3.5 INSTALLATION OF FIRE DEPARTMENT CONNECTIONS

- A. Install wall-type fire department connections.
- B. Install yard-type fire department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."
- C. Install two protective pipe bollards around each fire department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."
- D. Install automatic (ball-drip) drain valve at each check valve for fire department connection.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

- A. Install cover system, brackets, and cover components for sprinkler piping in accordance with manufacturer's installation manual and in accordance with NFPA 13 or NFPA 13R for supports.

3.7 INSTALLATION OF VALVES AND SPECIALTIES

- A. Install listed fire-suppression system control valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with manufacturer's installation instructions, NFPA standards, and AHJ.
- B. Install listed fire-suppression system shutoff valves in supervised open position, 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. System Control Valves:
 - 1. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
 - 2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
 - a. Install air compressor and compressed-air-supply piping.
 - b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer;

- pressure ratings with 14 to 60 psig adjustable range; and 175 psig maximum inlet pressure.
- c. Install compressed-air-supply piping from building's compressed-air piping system.
- 3. Install deluge valves with trim sets for drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
- D. Air Vent:
 - 1. Provide at least one air vent at high point in each wet-pipe fire-suppression system in accordance with NFPA standards. Connect vent into top of fire-suppression piping.
 - 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
 - 3. Pipe from outlet of air vent to drain.

3.8 INSTALLATION OF SPRINKLERS

- A. Install sprinklers in suspended ceilings symmetrically in center of narrow dimension of acoustical ceiling panels within tolerance of 1/2 inch. Coordinate entire pattern of sprinkler locations with approved reflected ceiling plan.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 INSTALLATION OF NITROGEN GENERATOR WITH PURGE/VENT SYSTEM

- A. Install in accordance with manufacturer's written installation instructions.
- B. Locate purge vent/valve in accordance with manufacturer's written installation instructions.
- C. Route alarm signals in code-approved electrical conduit from nitrogen generator system control panel to the supervisory circuit of BAS.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 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 fire-suppression systems in accordance with NFPA standards.
 4. Energize circuits to electrical equipment and devices.
 5. Start and run air compressors.
 6. Coordinate with fire-alarm tests. Operate as required.
 7. Coordinate with fire-pump tests. Operate as required.
 8. Verify that equipment hose threads are same as local fire department equipment.
 9. Verify that sprinklers' original factory finish has not been contaminated with dirt, debris, or paint. Sprinklers containing other-than-original factory finish are to be considered defective and replaced with new products. Repair and/or cleaning is not acceptable.
- C. Fire-suppression piping system will be considered defective if it does not pass tests and inspections.
- D. Fire-suppression piping system components considered defective during testing will be replaced with new components. Repair of defective components is not acceptable.
- E. Prepare test and inspection reports.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system control valves and pressure-maintenance pumps.

3.12 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
- D. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 (DN 50) and Smaller, to Be One of the Following:
1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Schedule 40, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings;

- and twist-locked joints.
 4. Schedule 40, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
 5. Schedule 40, black-steel pipe with [~~cut-~~][or][~~roll-~~] grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 6. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 7. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 8. Schedule 10, steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 9. Schedule 10, steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 10. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.
 11. Schedule 40 steel pipe; steel pressure-seal fittings; and pressure-sealed joints.
 12. Type L, hard copper tube with plain ends; cast- or wrought- copper, solder-joint fittings; and brazed joints.
 13. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 14. **NPS 2**, Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- E. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), to Be One of the Following:
1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Schedule 40, black-steel pipe with cut- or roll- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 6. Schedule 10, steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 7. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.
 8. Type L, hard copper tube with plain ends; cast- or wrought- copper, solder-joint fittings; and brazed joints.
 9. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 10. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- F. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 (DN 125) and Larger, to Be One of the Following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Schedule 40, black-steel pipe with cut- or roll- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 6. Schedule 10, steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 7. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.
 8. Type L, hard copper tube with plain ends; cast- or wrought- copper, solder-joint fittings; and brazed joints.
 9. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- G. High-Pressure, Wet-Pipe Sprinkler System, NPS 4 (DN 100) and Smaller, to Be One of the Following:
1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 4. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.
- H. High-Pressure, Wet-Pipe Sprinkler System, NPS 5 (DN 125) and Larger, to Be One of the Following:
1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 2. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 4. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Recessed sprinklers.

3. Wall Mounting: Horizontal sidewall sprinklers.
4. Spaces Subject to Freezing: Dry sidewall sprinklers.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated. Combustible concealed space sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces and locations not generally exposed to view; and wax coated where exposed to acids, chemicals, or other corrosive fumes.
2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
3. Flat Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
4. Residential Sprinklers: Dull chrome.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Packless expansion joints.
3. Alignment guides and anchors.
4. Sleeves without waterstop.
5. Sleeves with waterstop.
6. Grout.
7. Silicone sealants.
8. Escutcheons.
9. Thermometers, liquid in glass, lead free.
10. Pressure gauges, dial type, lead free.

B. Related Requirements:

1. Section 221119 "Domestic Water Piping Specialties" for water meters.
2. Section 221513 "General-Service Compressed-Air Piping" for compressed air gauges.
3. Section 331415 "Site Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of specified product, excluding motors which are included in Part 1 of the plumbing equipment Sections.
 - a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
 - b. Include operating characteristics and furnished accessories.

B. Delegated Design Submittals: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building

- structure.
- 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Sustainable Design Submittals:

- 1. Product Data: For sealants, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of expansion joint, and gauge to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Domestic water expansion fittings and loops for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
- C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

A. Performance Requirements:

1. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Provide products and installations that will accommodate maximum axial movement as scheduled or indicated on Drawings.

B. Packless Expansion Joints:

1. Rubber Union Connector Expansion Joints, Lead Free: RUEJLF-01.
 - 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) Amber Booth; a brand of VMC Group
 - 2) Flex-Hose Co., Inc
 - 3) Flexicraft Industries
 - 4) Flo Fab Inc
 - 5) General Rubber Corporation
 - 6) Kadant Unaflex, LLC
 - 7) Mason Industries, Inc.
 - 8) Metraflex Company (The)
 - 9) Proco Products, Inc
 - 10) Unisource Manufacturing, Inc.
 - b. Source Limitations: Obtain rubber union connector expansion joints from single manufacturer.
 - c. Material: Twin reinforced EPDM rubber spheres.
 - d. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
 - e. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - f. End Connections for Greater than NPS 2 (DN 50): Flanged.
 - g. End Fittings: Stainless-steel.

C. Alignment Guides and Anchors:

1. Alignment Guides: AG-01.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Thermal Systems, Inc
 - 2) ASC Engineered Solutions
 - 3) Flex-Hose Co., Inc
 - 4) Flex-Weld; a division of Kelco
 - 5) Flexicraft Industries
 - 6) Hyspan Precision Products, Inc

7) Metraflex Company (The)

- b. Source Limitations: Obtain alignment guides from single manufacturer.
- c. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe. Provide dielectric spacer for use with copper tubing/piping.

2. Anchor Materials:

- a. Steel Shapes and Plates: ASTM A36/A36M.
- b. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
- c. Washers: ASTM F844, steel, plain, flat washers.
- d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, zinc-coated carbon steel.
 - 2) Expansion Plug: Zinc-coated carbon steel.
 - 3) Washer and Nut: Zinc-coated carbon steel.
- e. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2) Stud: ASTM A307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - 3) Washer and Nut: Zinc-coated carbon steel.

2.3 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:

- 1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
- 2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
- 3. Steel Sheet Sleeves: ASTM A653/A653M, **24 gauge** minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
- 4. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- 5. Molded-PVC Sleeves: With nailing flange.
- 6. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.

B. Sleeves with Waterstop:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, LLC
 - b. American Polywater Corporation
 - c. CALPICO, Inc.
 - d. GPT Industries, LLC.
 - e. Metraflex Company (The)
2. Description: Manufactured PVC/HDPE, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: **5000 psi**, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

D. Silicone Sealants:

1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.4 ESCUTCHEONS

- 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. BrassCraft Manufacturing Co.; a Masco company
2. Dearborn Brass
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The)
5. Mid-America Fittings, LLC; A Midland Industries Company
6. ProFlo; a Ferguson Enterprises, Inc. brand

B. Escutcheon Types:

1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
 4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
 5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
 6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.
- C. Floor Plates:
1. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS, GENERAL

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF PACKLESS EXPANSION JOINTS

- A. Install metal-bellows expansion joints in accordance with EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
- B. Install rubber packless expansion joints in accordance with FSA-PSJ-703.

3.3 INSTALLATION OF GROOVED-JOINT EXPANSION JOINTS

- A. Install grooved-joint expansion joints to grooved-end steel piping.

3.4 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9.
 2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-58, Type 24; U bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
1. Anchor Attachment to Steel Structural Members: Attach by welding.
 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
 3. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

3.5 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.6 INSTALLATION OF SLEEVES - GENERAL

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout or silicone sealant, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of

floor/slab/wall.

- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.7 INSTALLATION OF SLEEVES WITH WATERSTOP

- A. Install sleeve with waterstop as new walls and slabs are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.
- C. Secure nailing flanges to wooden concrete forms.
- D. Using grout or silicone sealant, seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.8 INSTALLATION OF STACK-SLEEVE FITTINGS

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to **2 inches** above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with

requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.9 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.10 INSTALLATION OF ESCUTCHEONS

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.11 INSTALLATION OF METERS AND GAUGES

- A. Install thermometer with thermowell at each required thermometer location.
- B. Install thermowells in vertical position in piping tees.
- C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- D. Install thermowells with extension on insulated piping.
- E. Fill thermowells with heat-transfer medium.
- F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.
- H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.
- I. Install remote-mounted pressure gauges on panel.
- J. Install valve and snubber in piping for each pressure gauge for fluids.
- K. Install test plugs in piping tees.
- L. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.
5. Outlet side of hot-water-balancing valve.
6. Each main hot-water-recirculating line return pipe.

M. Install pressure gauges in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.12 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:
 - a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
 - b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.13 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:
 - a. Sleeves with waterstops.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs-on-Grade:
 - a. Sleeves with waterstops.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:

- a. Sleeves with waterstops or stack-sleeve fittings.
- 4. Interior Wall and Partitions:
 - a. Sleeves without waterstops.

3.14 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:

- 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
- 2. Chrome-Plated Piping: One piece, cast brass or split-casting brass with polished, chrome-plated finish.
- 3. Insulated Piping:
 - a. One-piece, stainless-steel with polished stainless-steel finish.
 - b. One piece, cast brass with polished, chrome-plated finish.
 - c. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stainless-steel with polished stainless-steel finish.
 - c. One piece, cast brass with polished, chrome-plated finish.
 - d. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- 5. Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stainless-steel with polished stainless-steel finish.
 - c. One piece, cast brass with polished, chrome-plated finish.
 - d. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- 6. Bare Piping in Unfinished Service Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, cast brass with polished, chrome-plated finish.
 - c. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- 7. Bare Piping in Equipment Rooms:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, cast brass with polished, chrome-plated finish.
 - c. One piece, stamped steel or split plate, stamped steel with concealed hinge or split plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

- B. Escutcheons for Existing Piping to Remain:
1. Chrome-Plated Piping: Split casting, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 2. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 5. Bare Piping in Unfinished Service Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 6. Bare Piping in Equipment Rooms: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping and Relocated Existing Piping: One piece, floor plate.
 2. Existing Piping: Split floor plate.

3.15 THERMOMETER, LEAD FREE, APPLICATION

- A. Thermometers at inlet and outlet of each domestic water heater are to be the following:
1. Sealed, bimetallic-actuated type.
 2. Direct -mounted, metal -case, vapor-actuated type.
 3. Metal case, compact -style, liquid-in-glass type.
 4. Direct -mounted, light-activated type.
 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger are to be the following:
1. Sealed, bimetallic-actuated type.
 2. Direct -mounted, metal -case, vapor-actuated type.
 3. Metal case, compact -style, liquid-in-glass type.
 4. Direct -mounted, light-activated type.
 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank are to be the following:
1. Sealed, bimetallic-actuated type.
 2. Direct -mounted, metal -case, vapor-actuated type.
 3. Metal case, compact -style, liquid-in-glass type.
 4. Direct -mounted, light-activated type.

5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- D. Thermometers at inlet and outlet of each remote domestic water chiller are to be the following:
1. Sealed, bimetallic-actuated type.
 2. Direct -mounted, metal -case, vapor-actuated type.
 3. Metal case, compact -style, liquid-in-glass type.
 4. Direct -mounted, light-activated type.
 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- E. Thermometer stems are to be of length to match thermowell insertion length.

3.16 THERMOMETER, LEAD FREE, SCALE-RANGE APPLICATION

- A. Scale Range for Domestic Cold-Water Piping:
1. 0 to 100 deg F.
 2. 0 to 150 deg F.
 3. 30 to 240 deg F.
- B. Scale Range for Domestic Hot-Water Piping:
1. 0 to 250 deg F.
 2. 20 to 240 deg F.
 3. 30 to 240 deg F.
- C. Insert additional paragraphs for thermometer scale ranges and applications.

3.17 PRESSURE-GAUGE APPLICATION

- A. Pressure gauges at discharge of each water service into building are to be the following:
1. Sealed Open front, pressure relief, direct mounted, metal case.
 2. Sealed, direct mounted, plastic case.
 3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Pressure gauges at inlet and outlet of each water pressure-reducing valve are to be the following:
1. Liquid filled Open front, pressure relief, direct mounted, metal case.
 2. Sealed, direct mounted, plastic case.
 3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Pressure gauges at suction and discharge of each domestic water pump are to be the following:
1. Liquid filled Open front, pressure relief, direct mounted, metal case.
 2. Sealed, direct mounted, plastic case.

3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.18 PRESSURE-GAUGE SCALE-RANGE APPLICATION

A. Scale Range for Water Service Piping:

1. 0 to 100 psi.
2. 0 to 160 psi.
3. 0 to 200 psi.

B. Scale Range for Domestic Water Piping:

1. 0 to 100 psi.
2. 0 to 160 psi.
3. 0 to 200 psi.
4. 0 to 300 psi.

END OF SECTION 220500

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Gate valves.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include material descriptions and dimensions of individual components.
 - b. Include operating characteristics and furnished accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for cast-copper solder-joint connections.
6. ASME B16.22 for wrought-copper solder-joint connections.
7. ASME B16.34 for flanged- and threaded-end connections.

8. ASME B16.51 for press joint connections.
 9. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.
- H. Valve Actuator Type:
1. Gear Actuator: For quarter-turn ball valves NPS 4 and larger.
 2. Hand Lever: For quarter-turn ball valves smaller than NPS 4.
- I. Valves in Insulated Piping:
1. Provide **2-inch** extended neck stems.
 2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 3. Provide memory stops that are fully adjustable after insulation is applied.

2.2 BALL VALVES, LEAD FREE

- A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Stainless-Steel Trim:
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. A.Y. McDonald Mfg. Co.
 - b. American Valve, Inc
 - c. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - d. Hammond Valve
 - e. Jenkins Valves; a Crane Co. brand
 - f. Jomar Valve
 - g. KITZ Corporation
 - h. Lance Valves
 - i. Marwin Valve; Richards Industries
 - j. Milwaukee Valve Company
 - k. Red-White Valve Corp.
 - l. Stockham; a Crane Co. brand

- m. Viega LLC
 - n. WATTS; A Watts Water Technologies Company
- 2. Standards: MSS SP-110 and MSS SP-145.
 - 3. CWP Rating: **600 psig**.
 - 4. Body Design: Two piece.
 - 5. Body Material: Forged brass.
 - 6. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
 - 7. Seats: PTFE.
 - 8. Stem: Stainless-steel.
 - 9. Ball: Stainless-steel, vented.
 - 10. Port: Full.

2.3 BALL VALVES, GENERAL PURPOSE

- A. Ball Valves, Threaded or Soldered Ends - Brass, Three Piece with Full Port and Stainless-Steel Trim:
 - 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. DynaQuip Controls
 - b. Marwin Valve; Richards Industries
 - c. WATTS; A Watts Water Technologies Company
 - 2. Standard: MSS SP-110.
 - 3. SWP Rating: **150 psig**.
 - 4. CWP Rating: **600 psig**.
 - 5. Body Design: Three piece.
 - 6. Body Material: Forged brass.
 - 7. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
 - 8. Seats: PTFE.
 - 9. Stem: Stainless-steel.
 - 10. Ball: Stainless-steel, vented.
 - 11. Port: Full.

2.4 CHECK VALVES, LEAD FREE

- A. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:
 - 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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - b. Crane Fluid Systems; Crane Co.

- c. Jenkins Valves; a Crane Co. brand
 - d. Jomar Valve
 - e. Keckley Company
 - f. Lance Valves
 - g. Milwaukee Valve Company
 - h. NIBCO INC.
 - i. Red-White Valve Corp.
 - j. Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
 - k. Stockham; a Crane Co. brand
 - l. Val-Matic Valve & Manufacturing Corp.
 - m. Victaulic Company
- 2. Standard: MSS SP-80, Type 3.
 - 3. CWP Rating: **200 psig**.
 - 4. Body Design: Horizontal flow.
 - 5. Body Material: ASTM B62, bronze.
 - 6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
 - 7. Disc: Bronze.

2.5 GATE VALVES, LEAD FREE

A. Gate Valves, Lead Free, Press Ends - Bronze:

- 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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - b. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems
 - c. Hammond Valve
 - d. Milwaukee Valve Company
 - e. NIBCO INC.
- 2. Standards: MSS SP-80 and MSS SP-139.
- 3. CWP Rating: Minimum **200 psig**.
- 4. Body Material: Bronze with integral seat and union-ring bonnet.
- 5. Ends: Press.
- 6. Press Ends Connection Rating: Minimum **200 psig**.
- 7. Stem: Brass or bronze, RS or NRS. See Part 3 gate valve schedule articles.
- 8. Disc: Solid wedge, bronze.
- 9. Packing: Graphite.
- 10. Port: Full.
- 11. Handwheel: Malleable iron, bronze, or aluminum.

2.6 GATE VALVES, GENERAL PURPOSE

A. Gate Valves, Threaded Ends - Bronze, NRS, Class 150:

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. American Valve, Inc
 - b. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - c. Crane Fluid Systems; Crane Co.
 - d. Jenkins Valves; a Crane Co. brand
 - e. KITZ Corporation
 - f. Lance Valves
 - g. Milwaukee Valve Company
 - h. Powell Valves
 - i. Red-White Valve Corp.
 - j. Stockham; a Crane Co. brand
 - k. WATTS; A Watts Water Technologies Company
2. Standard: MSS SP-80, Type 1.
3. CWP Rating: **300 psig**.
4. Body Material: ASTM B62, bronze with integral seat and union-ring bonnet.
5. Ends: Threaded.
6. Stem: Bronze.
7. Disc: Solid wedge, bronze.
8. Packing: Asbestos free.
9. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
- D. For valves in horizontal piping, install valves with stem at or above center of pipe.
- E. Install valves in position that does not project into aisles or block access to other equipment.
- F. Install valves in position to allow full stem and actuator or manual operator movement.
- G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.
- H. Install check valves for proper direction of flow and as follows:

1. Check Valves: Center-guided type and plate type, in horizontal or vertical position, between flanges.
 2. Check Valves, Swing Type: In horizontal position with hinge pin level.
 3. Check Valves, Lift Type: With stem upright and plumb.
- I. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
- J. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
 7. For Stainless-steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 8. For Stainless-steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends.
 9. For Grooved-End Copper Tubing: Valve ends may be grooved.
 10. For Grooved-End Steel Piping: Valve ends may be grooved.
 11. Wafer-Type Valves: Flanged connections.

3.3 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
1. Ball valves, lead free, threaded ends - brass, one piece.
 2. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and brass trim; threaded ends.
 3. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and stainless-steel trim; threaded ends.
 4. Ball valves, lead free, threaded or soldered ends - brass, two piece with regular port and brass trim; threaded ends.
 5. Ball valves, lead free, threaded or soldered ends - brass, two piece with regular

- port and stainless-steel trim; threaded ends.
6. Ball valves, lead free, threaded or soldered ends - brass, three piece with full port and brass trim; threaded ends.
 7. Ball valves, lead free, threaded or soldered ends - brass, three piece with full port and stainless-steel trim; threaded ends.
 8. Ball valves, lead free, threaded ends - bronze, one piece with bronze trim.
 9. Ball valves, lead free, threaded ends - bronze, one piece with stainless-steel trim.
 10. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and bronze or brass trim; threaded ends.
 11. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and stainless-steel trim; threaded ends.
 12. Ball valves, lead free, threaded ends - bronze, two piece with regular port and bronze or brass trim.
 13. Ball valves, lead free, threaded ends - bronze, two piece with regular port and stainless-steel trim.
 14. Ball valves, lead free, threaded ends - bronze, three piece with full port and bronze or brass trim.
 15. Ball valves, lead free, threaded ends - bronze, three piece with full port and stainless-steel trim.
 16. Ball valves, lead free, threaded or soldered ends - bronze, three piece with regular port and bronze or brass trim; threaded ends.
 17. Ball valves, lead free, threaded or soldered ends - bronze, three piece with regular port and stainless-steel trim; threaded ends.
 18. Ball valves, lead free, threaded or flanged ends - stainless-steel, two piece with full port; threaded ends.
 19. Ball valves, lead free, press ends - brass, two piece with full port and brass trim.
 20. Ball valves, lead free, press ends - brass, two piece with full port and stainless-steel trim.
 21. Ball valves, lead free, press ends - bronze, two piece with full port and bronze or brass trim.
 22. Ball valves, lead free, press ends - stainless-steel, two piece with full port.
 23. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; threaded ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Ball valves, lead free, flanged or threaded ends - iron, Class 125; flanged ends.
2. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; flanged ends.
3. Ball valves, lead free, flanged or threaded ends - steel, with regular port, Class 150; flanged ends.
4. Ball valves, threaded or flanged ends - stainless-steel, two piece with full port; threaded ends.

C. For CPVC Pipe:

1. CPVC Union-Type Ball Check Valve: NPS 2 and smaller 125 psig at 73 deg F.
 - a. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket or threaded.
 - b. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100):

Socket or threaded.

D. For PVC Pipe:

1. PVC Union-Type Ball Check Valve: NPS 4 and smaller 150 psig at 73 deg F.
 - a. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket.
 - b. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket.

3.4 DOMESTIC HOT- AND COLD-WATER BUTTERFLY VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Butterfly valves, lead free, single flange (lug type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.
2. Butterfly valves, lead free, single flange (lug type) - iron, with ductile-iron disc; 150 CWP, EPDM seat.
3. Butterfly valves, lead free, single flange (lug type) - iron, with stainless-steel disc; 150 CWP, EPDM seat.
4. Butterfly valves, lead free, flangeless (wafer type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.
5. Butterfly valves, lead free, flangeless (wafer type) - iron, with ductile-iron disc; 150 CWP, EPDM seat.
6. Butterfly valves, lead free, flangeless (wafer type) - iron, with stainless-steel disc; 150 CWP, EPDM seat.
7. Butterfly valves, lead free, grooved end - ductile iron, 175 CWP; EPDM seat.
8. Butterfly valves, lead free, grooved end - ductile iron, 300 CWP; EPDM seat.

B. For CPVC Pipe: CPVC butterfly valve for NPS 2-1/2 and larger.

C. For PVC Pipe: PVC butterfly valve for NPS 2-1/2 and larger.

D. For Stainless-steel Pipe: Stainless-steel, grooved-end butterfly valve for **NPS 2-1/2** and larger.

3.5 DOMESTIC HOT- AND COLD-WATER CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; threaded ends.
2. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; threaded ends.
3. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; threaded ends.
4. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; threaded ends.
5. Check valves, lead free, swing type, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 125; flanged ends.
2. Check valves, lead free, swing type, flanged or threaded ends - iron, with nonmetallic-to-metal Seats, Class 125; flanged ends.
3. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 250; flanged ends.
4. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever-and spring-closure control, Class 125; flanged ends.
5. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever-and weight-closure control, Class 125; flanged ends.
6. Check valves, lead free, swing type, grooved ends - iron, 300 CWP.
7. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 125.
8. Check valves, lead free, center guided - iron, globe, with metal seat, Class 125.
9. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 150.
10. Check valves, lead free, center guided - iron, globe, with metal seat, Class 150.
11. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 250.
12. Check valves, lead free, center guided - iron, globe, with metal seat, Class 250.
13. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 300.
14. Check valves, lead free, center guided - iron, globe, with metal seat, Class 300.
15. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 125; EPDM seat.
16. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 125; EPDM seat.
17. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 150; EPDM seat.
18. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 150; EPDM seat.
19. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 250; EPDM seat.
20. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 250; EPDM seat.
21. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 300; EPDM seat.
22. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 300; EPDM seat.
23. Check valves, lead free, dual-plate type - iron, with metal seat, Class 125.
24. Check valves, lead free, dual-plate type - iron, with metal seat, Class 150.
25. Check valves, lead free, dual-plate type - iron, with metal seat, Class 250.
26. Check valves, lead free, dual-plate type - iron, with metal seat, Class 300.
27. Check valves, lead free, single-plate type - iron, with resilient seat, Class 125; EPDM seat.
28. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 125; EPDM seat.
29. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 150; EPDM seat.

30. Check valves, lead free, single-plate type - iron, with resilient seat, Class 250; EPDM seat.
31. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 250; EPDM seat.
32. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 300; EPDM seat.

C. For CPVC Pipe:

1. NPS 2 (DN 50) and Smaller: Union ball valve.
2. NPS 4 (DN 100) and Smaller: Union ball valve.

D. For PVC Pipe:

1. NPS 2 (DN 50) and Smaller: Union ball valve.
2. NPS 4 (DN 100) and Smaller: Union ball valve.

3.6 PUMP-DISCHARGE CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; soldered ends.
2. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; soldered ends.
3. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; soldered ends.
4. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; soldered ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage:

1. Check valves, swing type, flanged ends - iron, with lever- and spring-closure control, Class 125.
2. Check valves, swing type, flanged ends - iron, with lever- and weight-closure control, Class 125.

3.7 DOMESTIC HOT- AND COLD-WATER GATE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Gate valves, lead free, threaded or soldered ends - bronze, NRS, Class 125; threaded or soldered ends.
2. Gate valves, lead free, threaded or soldered ends - bronze, RS, Class 125; threaded or soldered ends.
3. Gate valves, lead free, threaded ends - bronze, NRS, Class 150.
4. Gate valves, lead free, threaded ends - bronze, RS, Class 150.
5. Gate valves, lead free, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Gate valves, lead free, flanged ends - iron, NRS, Class 125.
2. Gate valves, lead free, flanged ends - iron, OS&Y, Class 125.
3. Gate valves, lead free, flanged ends - iron, NRS, Class 250.
4. Gate valves, lead free, flanged ends - iron, OS&Y, Class 250.

C. For CPVC Pipe:

1. NPS 2 (DN 50) and Smaller: Union gate valve.
2. NPS 4 (DN 100) and Smaller: Union gate valve.

D. For PVC Pipe:

1. NPS 2 (DN 50) and Smaller: Union gate valve.
2. NPS 4 (DN 100) and Smaller: Union gate valve.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports - metal.
2. Pipe hangers - metal, trapeze type.
3. Pipe hangers - FRP.
4. Strut support systems - metal.
5. Thermal hanger shield inserts.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220500 "Common Work Results for Plumbing" for pipe guides and anchors.
3. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Pipe hangers - metal, trapeze type.
2. Strut support systems - metal.
3. Strut support systems - FRP.
4. Pipe stands.
5. Equipment supports.

C. Delegated Design Submittals: For trapeze hangers and strut support systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication/assembly and design calculations for trapeze hangers.
2. Detail fabrication/assembly and design calculations for each type of strut support system, by manufacturer's technical representative.

- D. Delegated Design Engineer Qualifications: For trapeze hangers and strut support systems.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding Certificates: For structural-steel and pipe welding.

1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2025 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze hangers, strut support systems, and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 PIPE HANGERS AND SUPPORTS - METAL

- A. Pipe Hangers and Supports - Carbon Steel:
 - 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. Anvil; an ASC Engineered Solution
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. FNW; Ferguson Enterprises, Inc.
 - 2. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

3. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
4. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
5. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Pipe/Tube Hangers and Supports - Copper:

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. Anvil; an ASC Engineered Solution
 - b. Cooper B-line; brand of Eaton, Electrical Sector
 - c. FNW; Ferguson Enterprises, Inc.
2. Description: MSS SP-58, Types 1 through 58, copper-plated-steel, factory-fabricated components.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 PIPE HANGERS - METAL, TRAPEZE TYPE

A. Pipe Hangers - Metal, Trapeze Type:

1. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 PIPE HANGERS - FRP

A. Pipe Hangers - FRP, Clevis Type:

1. Description: Like MSS SP-58, Type 1 factory-fabricated steel pipe hanger, except hanger is made of FRP resin.
2. Hanger Rods: Continuous-thread stainless-steel rod, washer, and nuts made of FRP polyurethane or stainless-steel.
3. Flammability: ASTM D635, ASTM E84, UL 94.

2.5 STRUT SUPPORT SYSTEMS - METAL

A. Strut Support System - Metal, Rod Type:

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. ABB Electrification Installations Products
 - b. Anvil; an ASC Engineered Solution
 - c. Atkore Unistrut
 - d. CADDY; brand of nVent Electrical plc
 - e. Carpenter & Paterson, Inc
 - f. Cooper B-line; brand of Eaton, Electrical Sector
 - g. Empire Industries, Inc.
 - h. Flex-Strut Inc.
 - i. G-Strut
 - j. Haydon Corp.
 - k. PHD Manufacturing, Inc
 - l. Rocket Rack; Robroy Industries
 - m. Wesanco/ZSi-Foster; an Ideal Tridon Group Company
2. Description: Factory-fabricated pipe-support assembly, made of steel channels, vertical metal support rods, accessories, fittings, and other components for supporting multiple parallel pipes.
 3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 4. Struts: Continuous slotted carbon steel channel with inturned lips or angle.
 5. Strut Width: Selected for applicable load criteria.
 6. Strut Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 8. Metallic Coating: Pregalvanized G90.
 9. Paint Coating: Green epoxy, acrylic, or urethane.
 10. Plastic Coating: PVC.

2.6 THERMAL HANGER SHIELD INSERTS

A. Thermal Hanger Shield Insert - Polyisocyanurate:

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. Buckaroos, Inc.
 - b. KB Enterprise
 - c. National Pipe Hanger Corporation
 - d. Value Engineered Products, Inc.; an ASC Engineered
2. Insulation-Insert Material: ASTM C591, Type VI, Grade 1 polyisocyanurate with **125 psig** minimum compressive strength and vapor barrier.
 - a. ASTM E84, Flame Spread/Smoke Developed: 25/450.
3. Application: For insulated hot and cold piping not installed in return-air plenums.

4. For Trapeze or Clamped Systems: Insert and shield are to cover entire circumference of pipe.
5. For Clevis or Band Hangers: Insert and shield are to cover bottom 180 degrees of pipe.
6. Insert Length: Extend **2 inches** beyond sheet metal shield for piping operating below ambient air temperature.

B. Thermal Hanger Shield Insert - Phenolic:

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. Buckaroos, Inc.
2. Insulation-Insert Material: Rigid phenolic foam insulation, ASTM C1126, Type III, with ASTM E96 zero perm vapor barrier.
 - a. Minimum Compressive Strength, ASTM D1621: 40 psi minimum perpendicular to rise and 50 psi minimum parallel to rise.
 - b. ASTM E84, Flame Spread/Smoke Developed: 25/50.
3. Application: For hot and cold piping.
4. For Trapeze or Clamped Systems: Insert and shield are to cover entire circumference of pipe.
5. For Clevis or Band Hangers: Insert and shield are to cover bottom 180 degrees of pipe.
6. Insert Length: Extend **2 inches** beyond sheet metal shield for piping operating below ambient air temperature.

2.7 EQUIPMENT SUPPORTS

A. Equipment Support:

1. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon steel shapes.

2.8 MATERIALS

- A. Aluminum: **ASTM B221**.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; black and galvanized.
- D. Stainless-steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, no shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: **5000 psi**, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION OF HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Comply with requirements in Section 078400 "Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- B. Install lateral bracing with pipe hangers and supports to prevent swaying.
- C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Coordinate location of concrete inserts before concrete is placed.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- F. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe **NPS 4** and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.
 - a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe **NPS 4** and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): **12 inches** long and **0.048 inch** thick.
 - b. NPS 4 (DN 100): **12 inches** long and **0.06 inch** thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): **18 inches** long and **0.06 inch** thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): **24 inches** long and **0.075 inch** thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): **24 inches** long and **0.105 inch** thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- G. Pipe Hangers and Supports - Metal: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- H. Pipe Hangers - Metal, Trapeze Type: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 2. Field fabricate in accordance with ASTM A36/A36M carbon steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.
- I. Pipe Hangers - FRP: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- J. Strut Support Systems - Metal: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.
- K. Strut Support Systems - FRP: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.

- L. Thermal Hanger Shield Inserts: Install in pipe hanger or shield for insulated piping.
- M. Fastener Systems:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than **4 inches** thick after concrete is placed and cured. Use installers that are licensed by powder-actuated tool manufacturer.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners in accordance with manufacturer's written instructions.
 - 3. Install lag screw wood fasteners in accordance with manufacturer's written instructions.
 - 4. Install fasteners in accordance with manufacturer's written instructions.
- N. Hangers and Supports, General: Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- O. Equipment Supports:
 - 1. Fabricate from welded-structural-steel shapes.
 - 2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 - 3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
 - 4. Provide lateral bracing, to prevent swaying.

3.3 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers FRP pipe hangers and FRP strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.

- I. Use thermal hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes **NPS 1/2 to NPS 30**.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to **1050 deg F** pipes **NPS 4 to NPS 24**, requiring up to **4 inches** of insulation.
 - 3. Carbon Steel or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes **NPS 3/4 to NPS 36**, requiring clamp flexibility and up to **4 inches** of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes **NPS 1/2 to NPS 24** if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes **NPS 1/2 to NPS 4**, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes **NPS 3/4 to NPS 8**.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 8**.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 3**.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes **NPS 1/2 to NPS 30**.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes **NPS 4 to NPS 36**, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes **NPS 4 to NPS 36**, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes **NPS 2-1/2 to NPS 36** if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes **NPS 1 to NPS 30**, from two rods if longitudinal movement caused by expansion and contraction occurs.
 - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes **NPS 2-1/2 to NPS 24**, from single rod if horizontal movement caused by expansion and contraction occurs.
 - 19. Complete Pipe Rolls (MSS Type 44): For support of pipes **NPS 2 to NPS 42** if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 - 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes **NPS 2 to NPS 24** if small horizontal movement caused by expansion and contraction occurs and

- vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes **NPS 2 to NPS 30** if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers **NPS 3/4 to NPS 24**.
 2. Carbon Steel or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers **NPS 3/4 to NPS 24** if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to **6 inches** for heavy loads.
 2. Steel Clevises (MSS Type 14): For **120 to 450 deg F** piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For **120 to 450 deg F** piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

- a. Light (MSS Type 31): **750 lb.**
 - b. Medium (MSS Type 32): **1500 lb.**
 - c. Heavy (MSS Type 33): **3000 lb.**
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed **1-1/4 inches**.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vibration isolation pads and mounts.
2. Restraint devices.

B. Related Requirements:

1. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design wind load criteria for nonstructural components.
2. Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
3. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Include load rating for each wind-load-restraint device.
3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and wind-load-restraint component.
4. Annotate types and sizes of wind restraint devices, complete with listing markings or report number and load rating as evaluated by UL product listing.
5. Annotate to indicate application of each product submitted and compliance with requirements.
6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of Steel Rail Vibration Isolation Equipment Bases and Concrete Inertial Vibration Isolation Bases including anchorages and attachment to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Show coordination of wind-load restraints for components with other systems, equipment, and supports in the vicinity.

C. Delegated Design Submittals:

1. **Qualified Professional Engineer:** All delegated design and submittals for wind-load restraints must be signed and sealed by a qualified professional structural engineer responsible for their preparation. Structural engineer is to possess qualifications specified in Section 014000 "Quality Requirements," with expertise in structural engineering, including design of wind-load restraints, equipment hangers and supports, and concrete attachments.
2. For each vibration isolation device that is required by this Section or is indicated on Drawings, submit the following:
 - a. **Vibration Isolator Selection:** Select vibration isolators complying with performance requirements, design criteria, and analysis data.
 - b. **Vibration Isolation Device Design Calculations:** Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
 - c. **Coordinate vibration isolation details with wind-load restraint details** required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
3. **Riser Supports:** Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.
4. For each wind-load restraint device that is required by this Section or is indicated on Drawings, submit the following:
 - a. **Wind-Load-Restraints:** Select and submit wind-load restraints complying with performance requirements, design criteria, and analysis data.
 - b. **Pipe Riser Resilient Supports:** Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 - c. **Post-Installed Concrete Anchors and Inserts:** Include calculations showing anticipated wind loads.
 - d. **Wind-Load Restraint Design Calculations:** Submit all static and dynamic loading calculations prepared under "Wind-Load Restraint-Device Ratings" Paragraph in "Performance Requirements" Article.
5. **Wind-Load Restraint Detail Drawings:** Submit the following:
 - a. **Design Analysis:** To support selection and arrangement of wind-load restraints. Include calculations of combined tensile and shear loads.
 - b. **Details:** Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during wind events. Indicate association with vibration isolation devices.
 - c. **Coordinate wind-load restraint details with vibration isolation details**

required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

6. Product Listing, Preapproval, and Evaluation Documentation: ByUL, showing maximum ratings of restraint items and basis for approval (tests or calculations).

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation and wind-load reinforcement device installation for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.
- B. Welding Certificates: For specified shop or field welding.
- C. Air-Spring Mounting System Performance Certification: Include natural frequency, load, and damping test data.
- D. Field Quality Control Reports: For specified tests and inspections.
- E. Qualification Data: For professional engineer and testing agency.
 1. See Section 014000 "Quality Requirements" for qualification requirements.
- F. High-Wind Qualification Certification: Provide special certification for plumbing components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-load performance certification.
 1. Provide equipment manufacturer's written certification for each designated plumbing device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
 2. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.
 3. The following plumbing systems and components require special certification for high wind performance. Written special certification of resistance to the effects of high wind load and impact damage must be provided by manufacturer.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring vibration isolators to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.

- B. Delegated Design Professional Qualifications: A professional engineer who is legally qualified to practice in Florida where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to prepare wind-load restraint calculations and restraint devices selections in accordance with criteria specified in Section 018123 "Facility Seismic and Wind Criteria."
- B. Wind-Load Restraint-Device Ratings: Devices are to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices are to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: UL product listing.
 - 1. Wind-Load Restraint Performance: Equipment must be designed and secured to withstand effects of high wind events. See Section 018123 "Facility Seismic and Wind Criteria" for wind criteria for nonstructural components. See Drawings for identification of equipment required to be wind-load braced.
- C. Consequential Damage: Provide additional restraints for suspended plumbing system components or anchorage of floor-, roof-, or wall-mounted plumbing system component so that failure of a non-essential or essential fire-suppression system component will not cause failure of any other essential building component.
- D. Fire/Smoke Resistance: All components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of codes and authorities having jurisdiction. See Section 018123 "Facility Seismic and Wind Criteria" for basis-of-design criteria.

2.2 VIBRATION ISOLATION PADS AND MOUNTS

- A. Elastomeric Vibration Isolation Pad:

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. Ace Mountings Co., Inc.
 - b. Amber Booth; a brand of VMC Group
 - c. B-Line; a brand of Eaton
 - d. CADDY; brand of nVent Electrical plc
 - e. California Dynamics Corporation
 - f. CanFab; a brand of VMC Group
 - g. Kinetics Noise Control, Inc
 - h. Korfund
 - i. Mason Industries, Inc.
 - j. NOVIA; a division of Carpenter & Paterson
 - k. Vibration Eliminator Co., Inc
 - l. Vibration Isolation
 - m. Vibration Management Corp.
2. Source Limitations: Obtain elastomeric vibration isolation pads from single manufacturer.
3. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
4. Size: Factory or field cut to match requirements of supported equipment.
5. Pad Material: Oil- and water-resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
 - a. Surface Pattern: Smooth, ribbed, or waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.
 - a. Infused nonwoven cotton or synthetic fibers.
9. Minimum deflection as indicated on Drawings.

2.3 RESTRAINT DEVICES

A. Snubber:

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. Amber Booth; a brand of VMC Group
 - b. CADDY; brand of nVent Electrical plc
 - c. CanFab; a brand of VMC Group
 - d. Kinetics Noise Control, Inc

- e. Korfund
 - f. Mason Industries, Inc.
 - g. Vibration Eliminator Co., Inc
 - h. Vibration Management Corp.
- 2. Source Limitations: Obtain snubbers from single manufacturer.
 - 3. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 4. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be prequalified in accordance with ACI 355.2 testing and designated in accordance with applicable codes. See Section 018213 "Facility Seismic and Wind Criteria" for basis-of-design criteria.
 - 5. Preset Concrete Inserts: Prequalified in accordance with ICC-ES AC446 testing.
 - 6. Anchors in Masonry: Design in accordance with TMS 402.
 - 7. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 8. Resilient Cushion: Maximum **1/4-inch** air gap, and minimum **1/4 inch** thick.

2.4 POST-INSTALLED CONCRETE ANCHORS

- A. Expansion-type anchor bolts are not permitted for equipment in excess of **10 hp** that is not vibration isolated.
 - 1. Undercut expansion anchors are permitted.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to wind load forces.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and wind-load forces within specified loading limits.

3.2 INSTALLATION OF VIBRATION ISOLATION FOR PLUMBING

- A. Provide vibration isolation devices for systems and equipment where indicated in Equipment Schedules or Vibration Isolation and Wind-Load Restraint Schedules on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

- C. Installation of vibration isolators must not cause any change of position of equipment or piping resulting in stresses or misalignment.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

3.3 INSTALLATION OF RESTRAINT DEVICES

- A. Provide wind-load restraint devices for systems and equipment where indicated in Equipment Schedules or Wind-Load Controls Device Schedule, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Installation of wind-load restraint devices must not cause any change in position of equipment or piping resulting in stresses or misalignment.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- D. Equipment Restraints:
 - 1. Snubbers: Install on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inch**.
 - 3. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- E. Piping Restraints:
 - 1. Space lateral supports a maximum of 40 ft. o.c., and longitudinal supports a maximum of 80 ft. o.c.
 - 2. Brace a change of direction longer than **12 ft.**
- F. Install wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. Test and adjust restrained-air-spring isolator controls and safeties.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Units will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION 220548.13

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.

B. Related Requirements:

1. Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical, compressed-air system piping and associated components in healthcare facilities.
2. Section 226213 "Vacuum Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical surgical, healthcare laboratory, and dental vacuum system piping, waste anesthetic gas and oral evacuation system piping, and associated components in healthcare facilities.
3. Section 226313 "Gas Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical carbon dioxide, laboratory carbon dioxide, medical helium, laboratory helium, medical nitrogen, laboratory nitrogen, medical nitrous oxide, laboratory nitrous oxide, medical oxygen, and laboratory oxygen.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve-Numbering Scheme: For valve tags.
- E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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. Brady Corporation
 - b. Carlton Industries, LP
 - c. Champion America
 - d. Craftmark Pipe Markers
 - e. emedco
 - f. Kolbi Pipe Marker Co.
 - g. LEM Products Inc.
 - h. Marking Services Inc.
 - i. Pipemarket.com; Brimar Industries, Inc.
 - j. Seton Identification Products; a Brady Corporation company
2. Material and Thickness: Brass, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch**.
5. Minimum Letter Size: **1/4 inch** for name of units if viewing distance is less than **24 inches**, **1/2 inch** for viewing distances of up to **72 inches**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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. Brady Corporation
 - b. Carlton Industries, LP
 - c. Champion America
 - d. Craftmark Pipe Markers
 - e. emedco
 - f. Kolbi Pipe Marker Co.
 - g. LEM Products Inc.
 - h. Marking Services Inc.
 - i. Pipemarket.com; Brimar Industries, Inc.
 - j. Seton Identification Products; a Brady Corporation company

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 3. Letter and Background Color: As indicated for specific application under Part 3.
 4. Maximum Temperature: Able to withstand temperatures of up to **160 deg F**.
 5. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch**.
 6. Minimum Letter Size: **1/4 inch** for name of units if viewing distance is less than **24 inches**, **1/2 inch** for viewing distances of up to **72 inches**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- 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. Carlton Industries, LP
 3. Champion America
 4. Craftmark Pipe Markers
 5. emedco
 6. LEM Products Inc.
 7. Marking Services Inc.
 8. National Marker Company
 9. Pipemarker.com; Brimar Industries, Inc.
 10. Seton Identification Products; a Brady Corporation company
 11. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Maximum Temperature: Able to withstand temperatures of up to **160 deg F**.
- E. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch**.
- F. Minimum Letter Size: **1/4 inch** for name of units if viewing distance is less than **24 inches**, **1/2 inch** for viewing distances of up to **72 inches**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- 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. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation
 - 3. Carlton Industries, LP
 - 4. Champion America
 - 5. Craftmark Pipe Markers
 - 6. emedco
 - 7. Kolbi Pipe Marker Co.
 - 8. LEM Products Inc.
 - 9. Marking Services Inc.
 - 10. Pipemarket.com; Brimar Industries, Inc.
 - 11. Seton Identification Products; a Brady Corporation company
 - 12.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
 - 1. Pipe size.
 - 2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - 3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.4 STENCILS

A. Stencils for Piping:

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. Craftmark Pipe Markers
 - b. Kolbi Pipe Marker Co.
 - c. Marking Services Inc.
 - d. Pipemarket.com; Brimar Industries, Inc.
2. Lettering Size: Size letters in accordance with ASME A13.1 for piping.
3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel in colors in accordance with ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.2 INSTALLATION OF EQUIPMENT LABELS

- A. Permanently fasten labels on each item of plumbing equipment.
- B. Equipment Label Colors:
 1. White letters on an ANSI Z535.1 safety-green background.
- C. Locate equipment labels where accessible and visible.

3.3 INSTALLATION OF WARNING SIGNS AND LABELS

- A. Permanently fasten labels on each item of plumbing equipment.
- B. Warning Sign and Label Colors: In accordance with requirements of OSHA and other applicable codes and standards.
 - 1. Black letters on an ANSI Z535.1 safety-yellow background.
- C. Locate warning signs and labels where accessible and visible.
- D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF PIPE LABELS

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within **3 ft.** of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 3. Within **3 ft.** of equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
- E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of **125 deg F** or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
- F. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- G. Pipe-Label Color Schedule:

1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
2. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background
3. Domestic Hot-Water Return Piping White letters on an ANSI Z535.1 safety-green background.
4. Sanitary Waste Piping: White letters on a black background.
5. Storm Drainage Piping: White letters on a black background.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible elastomeric pipe insulation.
2. Glass-fiber pipe insulation.
3. Insulating cements.
4. Insulation adhesives.
5. Insulation sealants.
6. Field-applied insulation jackets.
7. Insulation securements.

B. Related Requirements:

1. Section 220716 "Plumbing Equipment Insulation" for equipment insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each specified system and assembly, including components and accessories.

1. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
3. Detail attachment and covering of heat tracing inside insulation.
4. Detail insulation application at pipe expansion joints for each type of insulation.
5. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
6. Detail removable insulation at piping specialties, equipment connections, and access panels.
7. Detail application of field-applied jackets.
8. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: **12 inches** long by **NPS 2**.
2. Jacket Materials for Pipe: **12 inches** long by **NPS 2**.
3. Sheet Jacket Materials: **12 inches** square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Environmental Product Declaration (EPD): For each product.
3. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
4. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- B. Field Quality Control Reports: For specified tests and inspections.
- C. Qualification Statements: For Installer and testing agency.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program, certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Testing Agency Qualifications: An independent agency qualified to perform specified field tests.

1.5 MOCKUPS

- A. Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Owner's Representative. Use materials indicated for the completed Work.
 1. Piping Mockups:

- a. One **10-ft.** section of **NPS 2** straight pipe.
 - b. One each of a 90-degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One **NPS 2** or smaller valve and one **NPS 2-1/2** or larger valve.
 - e. Four support hangers, including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
 - j. One union.
2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 3. Notify Owner's Representative seven days in advance of dates and times when mockups will be constructed.
 4. Obtain Owner's Representative's approval of mockups before starting insulation application.
 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
1. All Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.

2.2 PIPING INSULATION MATERIALS, GENERAL

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.
- B. Products are not to contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless-steel are to have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless-steel are to be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials are not to use CFC or HCFC blowing agents in the manufacturing process.
- F. Verify insulation complies with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.

2.3 FLEXIBLE ELASTOMERIC PIPE INSULATION

- A. Pipe Insulation - Flexible Elastomeric:
 - 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. Aeroflex USA
 - b. Armacell LLC
 - c. K-Flex USA
 - 2. Description: Closed-cell or expanded-rubber flexible elastomeric pipe insulation.
 - 3. Standard: ASTM C534/C534M, Type I, for tubular materials; Type II for sheet materials.
 - 4. Suitable for maximum use temperature between **minus 70 and plus 220 deg F.**

2.4 GLASS-FIBER PIPE INSULATION

- A. Pipe Insulation - Glass-Fiber, Preformed:
 - 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. Johns Manville; a Berkshire Hathaway company

- b. Knauf Insulation
 - c. Manson Insulation Inc.
 - d. Owens Corning
- 2. Description: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to **850 deg F** in accordance with ASTM C411. Comply with ASTM C547.
- 3. Preformed Pipe Insulation: Type I, Grade A.
- 4. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
- 5. Unfaced.
- 6. Factory-Applied Insulation Facing:
 - a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 - c. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII.
 - d. PSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

B. Pipe Insulation - Glass-Fiber, Pipe and Tank:

- 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. CertainTeed; SAINT-GOBAIN
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Manson Insulation Inc.
 - e. Owens Corning
- 2. Description: Glass fibers bonded with a thermosetting resin.
- 3. Standard: ASTM C1393.
- 4. Suitable for maximum use temperature between **35 and 850 deg F**, in accordance with ASTM C411.
- 5. Semirigid board material.
- 6. Factory-Applied Insulation Facing:
 - a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - b. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type III.
 - c. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII.
 - d. PSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene

backing; complying with ASTM C1136, Type II.

2.5 INSULATING CEMENTS

- A. Insulating Cement for Glass Fiber and Mineral Wool:
 - 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. Ramco Insulation, Inc.
 - 2. Standard: ASTM C195.
- B. Hydraulic-Setting Insulating and Finishing Cement for Glass Fiber and Mineral Wool:
 - 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. Ramco Insulation, Inc.
 - 2. Standard: ASTM C449.

2.6 INSULATION ADHESIVES

- A. Materials are to be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Insulation Adhesive for Lagging Cloth:
 - 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. Childers Brand; H. B. Fuller Construction Products
 - b. Foster Brand; H. B. Fuller
 - c. Vimasco Corporation
 - 2. Standard: MIL-A-3316C, Class I, Grade A.
 - 3. Adhesives to be compatible with insulation materials, jackets, and substrates.
 - 4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 5. Service Temperature Range: 20 to plus 180 deg F.
 - 6. Color: White.
 - 7. Verify adhesive is as recommended by insulation manufacturer and has a VOC content of 50 g/L or less.

C. Insulation Adhesive, Solvent Based, for Flexible Elastomeric and Polyolefin:

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. Aeroflex USA
 - b. Armacell LLC
 - c. Childers Brand; H. B. Fuller Construction Products
 - d. K-Flex USA
2. Description: Solvent-based adhesive for flexible elastomeric and polyolefin insulation.
3. Flame-spread index of 25 or less and smoke-developed index of 50 or less when tested in accordance with ASTM E84.
4. Wet Flash Point: Below **0 deg F**.
5. Service Temperature Range: **Minus 20 to plus 180 deg F** for full bonding of insulation sheets to metal substrate and **minus 20 to plus 250 deg F** for bonding of insulation seams and joints.
6. Maximum VOC: 617 g/L.

D. Insulation Adhesive for ASJ and FSK Facings/Jackets:

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. Childers Brand; H. B. Fuller Construction Products
 - b. Foster Brand; H. B. Fuller
 - c. Mon-Eco Industries, Inc.
2. Description: Pipe insulation adhesive for bonding ASJ and FSK facing/jacket insulation lap seams and joints.
3. Standard: MIL-A-3316C, Class 2, Grade A.
4. Verify adhesives have a VOC content of 80 g/L or less.

2.7 INSULATION MASTICS AND COATINGS

A. Materials are to be compatible with insulation materials, jackets, and substrates.

1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
2. Verify mastics comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.8 INSULATION SEALANTS

A. Insulation Joint Sealant:

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. Childers Brand; H. B. Fuller Construction Products
 - b. Foster Brand; H. B. Fuller
 - c. Mon-Eco Industries, Inc.
 - d. Owens Corning
2. Description: Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 58 to plus 176 deg F.
4. Color: White or gray.
5. Verify sealant has a VOC content of 420 g/L or less.

B. Flashing Sealant for FSK and Metal Jackets:

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. Childers Brand; H. B. Fuller Construction Products
 - b. Foster Brand; H. B. Fuller
 - c. Mon-Eco Industries, Inc.
2. Description: Flashing sealant to be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: **Minus 40 to plus 250 deg F.**
5. Color: Aluminum.
6. Verify sealant has a VOC content of 420 g/L or less.

2.9 FIELD-APPLIED INSULATION JACKETS

A. Field-applied jackets are to comply with ASTM C1136, Type I, unless otherwise indicated.

B. Insulation Jacket, Field Applied - Metal:

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. Johns Manville; a Berkshire Hathaway company
 - b. RPR Products, Inc.

2. Jacket Material - Aluminum:

- a. Description: Sheet and roll stock ready for shop or field sizing.
- b. Standard: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
- c. Finish and Thickness: As indicated in "Indoor, Field-Applied Insulation Jacket Schedule" and "Outdoor, Field-Applied Insulation Jacket Schedule" articles under Part 3.
- d. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
- e. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
- f. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Jacket Material - Stainless-steel:

- a. Description: Sheet and roll stock ready for shop or field sizing.
- b. Standard: ASTM A240/A240M.
- c. Material Type, Finish, and Thickness: As indicated in "Indoor, Field-Applied Insulation Jacket Schedule" and "Outdoor, Field-Applied Insulation Jacket Schedule" articles under Part 3.
- d. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
- e. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
- f. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 INSULATION SECUREMENTS

A. Insulation Bands:

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. Johns Manville; a Berkshire Hathaway company
 - b. RPR Products, Inc.
2. Insulation Bands - Stainless-steel: ASTM A240/A240M, Type 304 or Type 316; **0.015 inch** thick, 1/2 inch wide with wing seal or closed seal.
3. Insulation Bands - Aluminum: **ASTM B209**, Alloy 3003, 3005, 3105, or 5005; Temper H-14, **0.020 inch** thick, 1/2 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless-steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Insulation Staples:

1. Description: Outward clinching insulation staples, nominal **3/4 inch** wide, stainless-steel or Monel.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION, GENERAL

- A. Requirements in this article apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, and jackets, of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- E. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and

specialties.

- H. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the engineer-of-record.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 - 2. Cover circumferential joints with **3-inch-** wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced **4 inches** o.c.
 - 3. Overlap jacket longitudinal seams at least **1-1/2 inches**. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at **4 inches** o.c.
 - 4. For below-ambient services, apply vapor-barrier mastic over staples.
 - 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- Q. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.
- R. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

- S. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- T. Removable Insulation Covers:

Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least **2 inches** over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.2 INSTALLATION OF FLEXIBLE ELASTOMERIC PIPE INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation on:
 1. Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow

passage of air to surface being insulated.

2. Pipe Fittings and Elbows:

- a. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
- b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3. Valves and Pipe Specialties:

- a. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
- b. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- c. Install insulation to flanges as specified for flange insulation application.
- d. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- C. Finish: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.3 INSTALLATION OF GLASS-FIBER PIPE INSULATION

A. Insulation on:

1. Straight Pipes and Tubes:

- a. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
- b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
- c. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at **6 inches** o.c.
- d. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

2. Pipe Flanges:

- a. Install prefabricated pipe insulation to outer diameter of pipe flange.
- b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or

- mineral-wool blanket insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least **1 inch**, and seal joints with flashing sealant.
- 3. Pipe Fittings and Elbows:
 - a. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
 - b. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- 4. Valves and Pipe Specialties:
 - a. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
 - b. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - d. Install insulation to flanges as specified for flange insulation application.

3.4 INSTALLATION OF FIELD-APPLIED INSULATION JACKETS

- A. Insulation Jacket, Field-Applied - FSK:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with **1-1/2-inch** laps at longitudinal seams and **3-inch-** wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Insulation Jacket, Field-Applied - PVC:
 - 1. Install with **1-inch** overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - 2. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Insulation Jacket, Field-Applied - Metal:
 - 1. Install with **2-inch** overlap at longitudinal seams and end joints.
 - 2. Overlap longitudinal seams arranged to shed water.
 - 3. Seal end joints with weatherproof sealant recommended by insulation manufacturer.
 - 4. Secure jacket with stainless-steel bands **12 inches** o.c. and at end joints.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- E. All insulation applications will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.7 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water Piping:
 - 1. Insulation for pipe size NPS 1 (DN 25) and smaller is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 1/2 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1/2 inch thick.
 - 2. Insulation for pipe size NPS 1-1/4 (DN 32) and larger is to be one of the following:

- a. Pipe Insulation - Flexible Elastomeric: 1 inch thick.
- b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water Piping:

- 1. Insulation for pipe size NPS 1-1/4 (DN32) and smaller is to be one of the following:
 - a. Pipe Insulation - Cellular Glass Preformed: 1-1/2 inches thick.
 - b. Pipe Insulation - Flexible Elastomeric: 3/4 inch thick.
 - c. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.
- 2. Insulation for pipe size NPS 1-1/2 (DN 40) and larger is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 1 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

C. Domestic Chilled Water (Potable) Piping:

- 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 1 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

D. Stormwater and Overflow Piping:

- 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 1 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:

- 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 1 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

- 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 3/4 inch thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

- 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Cellular Glass: 2 inches thick.

- b. Pipe Insulation - Glass-Fiber, Preformed: 1-1/2 inches thick.
- H. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Cellular Glass: 1-1/2 inches thick.
 - b. Pipe Insulation - Flexible Elastomeric: 3/4 inch thick.
 - c. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.
- I. Hot Service Drains and Piping:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.
- J. Hot Service Vent Piping:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

3.8 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Water Piping:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 2 inches thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 2 inches thick.
- B. Domestic Hot and Recirculated Hot Water Piping:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Flexible Elastomeric: 2 inches thick.
 - b. Pipe Insulation - Glass-Fiber, Preformed: 2 inches thick.
- C. Sanitary Waste Piping Where Heat Tracing Is Installed:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Glass-Fiber, Preformed: 2 inches thick.
- D. Hot Service Drains and Piping:
 - 1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

E. Hot Service Vent Piping:

1. Insulation for all pipe sizes is to be one of the following:
 - a. Pipe Insulation - Glass-Fiber, Preformed: 1 inch thick.

3.9 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Pipe insulation - cellular glass, preformed 2 inches thick.
- B. Chilled Water, All Sizes: Pipe insulation - cellular glass, preformed 2 inches thick.

3.10 INDOOR, FIELD-APPLIED INSULATION JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed from View:
 1. None.
 2. PVC: Standard.
 - a. Thickness: 20 mils.
 3. Aluminum: Smooth.
 - a. Thickness: 0.016 inch.
 4. Painted Aluminum: Smooth.
 - a. Thickness: 0.016 inch.
 5. Stainless-steel: Type 304 or Type 316, smooth No. 2B finish.
 - a. Thickness: 0.010 inch.
- D. Piping, Exposed to View:
 1. None.
 2. PVC: Standard.
 - a. Thickness: 20 mils.
 3. Aluminum: Smooth.
 - a. Thickness: 0.016 inch.

4. Painted Aluminum: Smooth.
 - a. Thickness: 0.016 inch.
5. Stainless-steel: Type 304 or Type 316, smooth No. 2B finish.
 - a. Thickness: 0.010 inch.

3.11 OUTDOOR, FIELD-APPLIED INSULATION JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed from View:
 1. None.
 2. PVC: Standard.
 - a. Thickness: 20 mils.
 3. Aluminum: Smooth.
 - a. Thickness: 0.016 inch.
 4. Painted Aluminum: Smooth.
 - a. Thickness: 0.016 inch.
 5. Stainless-steel: Type 304 or Type 316, smooth No. 2B finish.
 - a. Thickness: 0.010 inch.
- D. Piping, Exposed to View:
 1. PVC: Standard.
 - a. Thickness: 20 mils.
 2. Aluminum: Smooth with 1-1/4-inch- deep corrugations.
 - a. Thickness: 0.032 inch.
 3. Painted Aluminum: Smooth with 1-1/4-inch- deep corrugations.
 - a. Thickness: 0.032 inch.
 4. Stainless-steel: Type 304 or Type 316, smooth, with 1-1/4-inch- deep corrugations.

- a. Thickness: 0.020 inch.

END OF SECTION 220719

SECTION 221113

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.04 ACTION 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.
 - 1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.05 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

- A. 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.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- 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 ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- G. NSF Compliance:
1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.08 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.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.09 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 written permission.

1.010 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 2. Copper, Pressure-Seal Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - b. NPS 2-1/2 to NPS 3: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 2. Copper, Pressure-Seal Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - b. NPS 2-1/2 to NPS 3: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. Pressure class 350.

- B. Flanged Pipe: ANSI B16.1, Class 250 and AWWA C110, C115, and C151. Bolts, nuts, and studs for flanged joints shall be hexagonal type of low-carbon steel conforming to ASTM A307 Grade B and ANSI B18.2.
- C. Fittings: Pressure class 350. Ductile iron fittings, with either mechanical joints or flanges, shall comply with ANSI A21.10 and AWWA C110 or ANSI A21.53 and AWWA C153.
- D. All ductile iron pipe and fittings shall have a standard cement lining complying with ANSI A21.4.
- E. Pipe and fittings to be installed underground shall be asphaltic coated in accordance with ANSI A21.4.
- F. Above ground exposed piping shall be thoroughly cleaned of all dirt, mill scale, or rust and prime coated with Tnemac 77 or equivalent coating approved by the Water Works Board of the City of Enterprise and the project engineer.
- G. Gaskets:
 - 1. Standard gaskets for push-on joint ductile iron pipe shall be manufactured of Styrene Butadiene Rubber (SBR) conforming to the material requirements of ANSI A21.11, and AWWA C111, and shall be ANSI/NSF Standard 61 certified for contact with potable water.
 - 2. Locking or restrained joint gaskets for push-on joint ductile iron pipe shall be standard SBR gaskets with high strength stainless steel wedging elements equally spaced around the gasket for restraining action. Locking gasket fittings shall comply with ANSI A21.11 and A21.53 and AWWA C111 and C153 and shall be ANSI/NSF Standards 61 certified for contact with potable water.
 - 3. Full-face or ring gaskets for flanged ductile iron pipe shall be SBR conforming to the material requirements of ANSI A21.11 and AWWA C111 and shall be ANSI/NSF Standard 61 certified for contact with potable water.

2.03 JOINING MATERIALS

- A. Ductile iron pipe with push-on and mechanical joints and fittings shall conform to ANSI A21.11 and AWWA C111.
- B. Ductile iron pipe with flanged joints and fittings shall conform to ANSI A21.10, A21.15, B16.1, and AWWA C110.
- C. Joint materials for push-on and mechanical joints shall be furnished by the manufacturer of the pipe and shall comply with ANSI A21.11.

2.04 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Split-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - a. Standard: AWWA C219.

- b. Sleeve Material: Stainless steel.
 - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - e. Pressure Rating: 200 psig minimum.
 - f. Metal Component Finish: Corrosion-resistant coating or material.
- C. Flexible Couplings: For ductile iron pipe shall be mechanical joint sleeves or Dresser Couplings, Style 38.

2.05 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves:

- a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.

2. 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.

2.06 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.

2.07 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: 175 psig.

2.08 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: 175 psig.
 - c. 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: 175 psig.

2.09 WATER METERS

- A. Water meters shall be manufactured by Neptune and shall be equipped with R-900 radio read systems attached to the lid.

2.010 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

- 1. The device shall meet AWWA C511-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.

B. Double-Check, Backflow-Prevention Assemblies:

- 1. The device shall meet AWWA C510-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.

C. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.011 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, 4,000 psi concrete mix with steel wire and bar reinforcement in accordance with the City of Enterprise.

1. Ladder: Steel reinforced polypropylene steps mounted in the concrete.
2. Hatch: Aluminum construction rated for a minimum of 300 lb/sf loading. All hardware shall be type 316 stainless steel. The hatch shall be equipped with an automatic hold-open door device, water tight slamlock and removable key wrench. The frame and cover shall be cast into the concrete and shall be flush with the top of the concrete. The hatch shall span the entire length and width of the vault to provide maximum opening access to the interior of the vault. The hatch shall be manufactured by U.S. Foundry, Bilco, or approved equal.
3. Drain: The drain shall be 3" in diameter and cast into the floor. No side drains will be permitted.

2.012 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.
 - a. Standard: ASSE 1060.
 - b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - 1) Housing: Reinforced-aluminum construction.
 - a) Access doors with locking devices.
 - b) Insulation inside housing.
 - c) Anchoring devices for attaching housing to concrete base.
 - 2) Electric heating cable or heater with self-limiting temperature control.

2.013 FIRE HYDRANTS

A. Per local fire department requirements.

1. Description: Shall be Mueller Centurion or American Darling Model B84B, traffic type hydrants. Fire hydrants shall be furnished with two (2) hose connections each 2-1/2" in diameter and one 4-1/2" diameter pumper connection. The valve openings shall be 5" and

the standpipe shall be 6" inside diameter. Hydrants shall be designed for mechanical joint connections and shall be equipped with safety flanges.

- a. Standard: AWWA C502.
- b. Nozzles and caps shall be chased to National Standard hose and steamer nozzle threads (see B-26-1925, with latest revisions).
- c. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise. An arrow and the word "open" shall be cast in relief on the top of the hydrant to designate the direction of opening.
- d. Exterior Finish: The outside of the top section of the hydrant shall be thoroughly cleaned and given a coat of primer per AWWA C502 and a second coat of yellow high gloss machinery enamel. The Contractor shall repaint hydrants after installation if the paint is damaged or the appearance marred by handling.

2.014 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

- 1. Per Enterprise Fire Department requirements.

2.015 ALARM DEVICES

- A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide 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 when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

- E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 to NPS 8 shall be the following:
 - 1. Ductile-iron, push-on-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 3 shall be same as underground water-service piping.
- H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. PVC, Schedule 80 Pipe; PVC, Schedule 80 Socket Fittings; and Solvent-cemented threaded fittings; and threaded joints.
- I. Aboveground and vault water-service piping NPS 4 to NPS 8 shall be the following:
 - 1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
- J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
 - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- K. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- L. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be the following:
 - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- M. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.03 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising rising stem.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated UL/FMG, cast iron, OS&Y rising stem.
 - c. Check Valves: AWWA C508, swing type.
4. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.04 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of The City of Enterprise and of size and in location indicated.
- B. Make connections larger than NPS 2 with tapping machine according to the following:
 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Make connections NPS 2 and smaller with drilling machine according to the following:
 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 4. Install corporation valves into service-saddle assemblies.
 5. Install manifold for multiple taps in water main.
 6. Install curb valve in water-service piping with head pointing up and with service box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
 1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
- F. Bury piping with depth of cover over top at least 30 inches, with top at least below level of maximum frost penetration, and according to the following:
 1. Under Driveways: With at least 36 inches cover over top.
 2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.
- G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

- H. 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.
- I. 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.

3.05 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 - 2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

3.06 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 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. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 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. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

- E. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.08 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.

3.09 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written instructions.

3.010 ROUGHING-IN FOR WATER METERS

- A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.011 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.

3.012 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 2 inches above surface.

3.013 CONCRETE VAULT INSTALLATION

- A. Install precast concrete vaults according to ASTM C 891.

3.014 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately 2 inches above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

3.015 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.016 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.

3.017 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.
- C. Connect waste piping from concrete vault drains to storm-drainage system. See Section 334100 "Storm Utility Drainage Piping" for connection to storm-sewer piping.

3.018 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.
- C. Prepare reports of testing activities.

3.019 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.020 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

- NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. 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. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. 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

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings - domestic water.
 - 2. Pipe joining materials - domestic water.
 - 3. Dielectric fittings - domestic water.
- B. Related Requirements:
 - 1. Section 331415 "Site Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Environmental Product Declaration (EPD): For each product.
 - 3. Environmental Product Declaration (EPD): For each product.
 - 4. Third-Party Certifications: For each product.
 - 5. Third-Party-Certified Life-Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. System purging and disinfecting activities report.
- C. Field Quality Control Reports: For specified tests and inspections.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service in accordance with requirements indicated:
 - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Owner's Representative's written permission.

1.6 WARRANTY

- A. Polypropylene (PP-R and PP-RCT) Pipe and Fittings Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R and PP-RCT pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
 - 1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of piping system due to defects in materials or manufacturing.
 - 2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372, or be certified in compliance with NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

- A. Potable-water piping and components are to comply with NSF/ANSI 14, NSF/ANSI/CAN 61, and NSF/ANSI/CAN 372. Include marking "NSF-pw" on piping.

2.3 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Copper Tube, Drawn Temper - Domestic Water:

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. Cambridge-Lee Industries, LLC
 - b. Cerro Flow Products, LLC
 - c. Mueller Streamline Co.; a company of Mueller Industries
2. Standard: ASTM B88, Type K ASTM B88, Type L and ASTM B88, Type M.

B. Copper Tube, Annealed Temper - Domestic Water:

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. Cambridge-Lee Industries, LLC
 - b. Cerro Flow Products, LLC
 - c. Mueller Streamline Co.; a company of Mueller Industries
2. Standard: ASTM B88, Type K ASTM B88, Type L and ASTM B88, Type M.

C. Copper Tube Fittings, Solder Joint - Domestic Water:

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. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems
 - b. Mueller Streamline Co.; a company of Mueller Industries
 - c. NIBCO INC.

D. Cast-Copper, Solder-Joint Fittings - Domestic Water: ASME B16.18, pressure fittings. Do not use solder joints on pipe sizes greater than **NPS 4**.

E. Wrought-Copper, Solder-Joint Fittings - Domestic Water: ASME B16.22, pressure fittings. Do not use solder joints on pipe sizes greater than **NPS 4**.

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. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems
 - b. Mueller Streamline Co.; a company of Mueller Industries
 - c. NIBCO INC.

F. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than **NPS 4**.

- G. Wrought Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than **NPS 4**.
- H. Copper Tube Fittings, Mechanically Formed Tee - Domestic Water: For forming T-branch on copper water tube.
 - 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. T-DRILL Industries Inc
 - 2. Description: Tee formed in copper tube in accordance with ASTM F2014.
- I. Copper Tube Appurtenances, Grooved End, Mechanical Joint - Domestic Water:
 - 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. Anvil; an ASC Engineered Solution
 - b. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - c. ASC Engineered Solutions
 - d. Shurjoint; a brand of Aalbert Integrated Piping Systems (Aalberts Industries)
 - e. Victaulic Company
 - 2. Source Limitations: Obtain appurtenances for grooved-end, mechanical-joint copper tube from single manufacturer.
 - 3. Grooved-End Copper Fittings: ASTM B75/B75M copper tube or ASTM B584 bronze castings.
 - 4. Grooved-End-Tube Couplings: To fit copper tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; **300 psig** minimum CWP pressure rating.
- J. Copper or Bronze, Pressure-Seal-Joint Fittings - Domestic Water:
 - 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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - b. Conex Bänninger; a part of IBP Group LLC
 - c. Copper Press Brand; Merit Brass Company
 - d. Elkhart Brass Mfg. Co., Inc
 - e. FNW; Ferguson Enterprises, Inc.
 - f. Mueller Streamline Co.; a company of Mueller Industries

- g. NIBCO INC.
- h. Viega LLC
- 2. Source Limitations: Obtain copper or bronze pressure-seal-joint fittings from single manufacturer.
- 3. Housing: Copper.
- 4. O-Rings and Pipe Stops: EPDM.
- 5. Tools: Manufacturer's special tools.
- 6. Working-Pressure Rating: Minimum **200 psig** at **250 deg F**.

2.4 PIPE JOINING MATERIALS - DOMESTIC WATER

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, **1/8 inch** thick or ASME B16.21, nonmetallic and asbestos free.
 - 2. Full-face or ring type.
- B. Metal Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- C. Solder Filler Metals: ASTM B32, lead-free alloys.
- D. Flux: ASTM B813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.
 - 1. Verify CPVC welding solvent cement has a VOC content of 490 g/L or less.
 - 2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.
 - 1. Product Data:
 - a. Verify PVC welding solvent cement has a VOC content of 510 g/L or less.
 - b. Verify adhesive primer has a VOC content of 550 g/L or less.
 - 2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

3. Verify adhesive primer complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- H. Plastic Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended in writing by piping system manufacturer.

2.5 TRANSITION FITTINGS - DOMESTIC WATER

- A. General Requirements:
 1. Same size as pipes to be joined.
 2. Pressure rating at least equal to pipes to be joined.
 3. End connections compatible with pipes to be joined.

2.6 DIELECTRIC FITTINGS - DOMESTIC WATER

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions - Domestic Water:
 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. A.Y. McDonald Mfg. Co.
 - b. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - c. HART Industrial Unions, LLC
 - d. Jomar Valve
 - e. Matco-Norca
 - f. WATTS; A Watts Water Technologies Company
 - g. Wilkins; Zurn Elkay
 - h. Zurn; Zurn Elkay
 2. Source Limitations: Obtain dielectric unions from single manufacturer.
 3. Standard: ASSE/IAPMO/ANSI/CAN 1079.
 4. Pressure Rating: 125 psig minimum at 180 deg F.
 5. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 DOMESTIC WATER PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications in paragraphs below.
- B. Flanges and unions may be used for aboveground piping joints.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab, Domestic Water, Building-Service Piping, NPS 3 (DN 80) and Smaller: To be the following:
 - 1. Annealed-Temper Copper Tube: ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 - 3. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- E. Under-Building-Slab, Domestic Water, Building-Service Piping, NPS 4 to NPS 8 (DN 100 to DN 200) and Larger: To be the following:
 - 1. Annealed-Temper Copper Tube: ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Mechanical-Joint, Ductile-Iron Pipe: Standard or compact pattern, mechanical-joint fittings, and mechanical joints.
 - 3. Push-on-Joint, Ductile-Iron Pipe: Standard or compact pattern, push-on-joint fittings, and gasketed joints.
 - 4. Plain-End, Ductile-Iron Pipe: Grooved-end, ductile-iron-pipe appurtenances; and grooved joints.
 - 5. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 - 6. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- F. Under-Building-Slab, Combined Domestic Water, Building-Service, and Fire-Service-Main Piping, NPS 6 to NPS 12 (DN 150 to DN 300): To be the following:
 - 1. Mechanical-Joint, Ductile-Iron Pipe: Standard or compact pattern, mechanical-joint fittings, and mechanical joints.
 - 2. Push-on-Joint, Ductile-Iron Pipe: Standard or compact pattern, push-on-joint fittings, and gasketed joints.
 - 3. Plain-End, Ductile-Iron Pipe: Grooved-end, ductile-iron-pipe appurtenances; and grooved joints.
- G. Under-Building-Slab, Domestic Water Piping, NPS 2 (DN 50) and Smaller: To be the following:

1. Drawn-Temper Copper Tube: **ASTM B88, Type L**; wrought-copper, solder-joint fittings; and brazed joints.
 2. Annealed-Temper Copper Tube: **ASTM B88, Type L**; wrought-copper, solder-joint fittings; and brazed joints.
 3. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 4. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- H. Aboveground Domestic Water Piping, NPS 2 (DN 50) and Smaller: To be the following:
1. Drawn-Temper Copper Tube: ASTM B88, Type L.
 - a. Cast-copper or wrought-copper solder-joint fittings and brazed joints.
 - b. Copper pressure-seal-joint fittings and pressure-sealed joints.
 - c. Copper push-on-joint fittings; and push-on joints.
 2. CPVC Pipe: Schedule 80 socket fittings and solvent-cemented joints.
 3. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 4. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- I. Aboveground Domestic Water Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): To be the following:
1. Drawn-Temper Copper Tube: ASTM B88, Type L.
 - a. Cast-copper or wrought-copper solder-joint fittings and brazed joints.
 - b. Copper pressure-seal-joint fittings and pressure-sealed joints.
 - c. Grooved-end, copper-tube appurtenances; and grooved joints.
 2. CPVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 3. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 4. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- J. Aboveground Domestic Water Piping, NPS 5 to NPS 8 (DN 125 to DN 200): To be the following:
1. Drawn-Temper Copper Tube: ASTM B88, Type L.
 - a. Cast-copper or wrought-copper solder-joint fittings and brazed joints.
 - b. Grooved-end, copper-tube appurtenances; and grooved joints.
 2. CPVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 3. PVC Pipe: Schedule 40, socket fittings, and solvent-cemented joints.
 4. Polypropylene (PP-R and PP-RCT) Pipe: SDR 7.4 pipe and socket-fusion, butt-fusion, fusion-outlet, or electrofusion fittings and joints.
- K. Aboveground, Combined Domestic Water-Service and Fire-Service-Main Piping, NPS 6 to NPS 12 (DN 150 to DN 300): To be the following:

1. Plain-End, Ductile-Iron Pipe: Grooved-end, ductile-iron-pipe appurtenances; and grooved joints.

3.2 INSTALLATION OF DOMESTIC WATER PIPING, GENERAL

- A. Requirements in this article apply to all piping materials, except where more specific requirements are specified in various pipe and fittings installation articles.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- C. Install valves in accordance with Section 220523 "General-Duty Valves for Plumbing Piping."
- D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- F. Rough-in domestic water piping for water-meter installation in accordance with utility company's requirements.
- G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. 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.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install pressure gauges on suction and discharge piping for each plumbing pump and

packaged booster pump. Comply with requirements for pressure gauges in Section 220500 "Common Work Results for Plumbing."

- P. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123.21 "Inline, Domestic-Water Pumps."
- Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220500 "Common Work Results for Plumbing."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."
- U. Joint Construction, General:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 - 3. Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - 4. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 INSTALLATION OF COPPER TUBE AND FITTINGS - DOMESTIC WATER

- A. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."
- B. Install underground copper tube in polyethylene encasement in accordance with ASTM A674 or AWWA C105/A21.5.
- C. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- D. Joint Construction:

1. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
2. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings in accordance with ASTM B828 or CDA's "Copper Tube Handbook."
3. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended in writing by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
4. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gauge. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
5. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
6. Grooved-End Copper Tubing: Make joints in accordance with AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

3.4 INSTALLATION OF POLYPROPYLENE PIPING AND FITTINGS - DOMESTIC WATER

- A. Install Polypropylene piping and fitting per manufacturer's instructions.
- B. Joint Connections:
 1. Jointing Polypropylene Piping and Fittings, ASTM and ISO: Join by the use of the thermal fusion method specifically approved by the manufacturer based on ASTM F2389 and ISO 15874.

3.5 INSTALLATION OF DIELECTRIC FITTINGS - DOMESTIC WATER

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Metal Tube/Pipe:

1. Install hangers with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
2. Support vertical runs of metal tube/pipe to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Plastic Pipe:

1. Install vinyl-coated hangers with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
2. Support vertical runs of plastic pipe to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. 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:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of

- portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of **50 psig** above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Polypropylene (PP-R and PP-RCT) Pipe: Hydrostatic testing and documentation of test results for polypropylene (PP-R and PP-RCT) pipe to be in accordance with manufacturer's written instructions and submitted to manufacturer upon successful completion per warranty requirements.
 - f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - g. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Automatic water shutoff valve systems.
4. Balancing valves.
5. Outlet boxes.
6. Wall hydrants.
7. Water-hammer arresters.
8. Trap-seal primer device.
9. Trap-seal primer systems.
10. Flexible connectors.

B. Related Requirements:

1. Section 220500 "Common Work Results for Plumbing."
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 222500 "Plumbing Systems Water Treatment" for water treatment in domestic water piping.
4. Section 223100 "Domestic Water Softeners" for producing softened water in domestic water piping.
5. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
6. Section 224300 "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
7. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
8. Section 224700 "Drinking Fountains and Water Coolers."
9. Section 230923.18 "Leak Detection Instruments" for leak detection devices related to HVAC applications.
10. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for making wiring connections.
11. Section 260523 "Control-Voltage Electrical Power Cables" for connection of control wiring.
12. Section 260526 "Grounding and Bonding for Electrical Systems" for grounding of equipment.
13. Section 331415 "Site Water Distribution Piping" for fire water-service backflow-prevention devices.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Test and Inspection Reports: For vacuum breaker, pressure type backflow preventer, reduced-pressure-principle type backflow-prevention assembly, double-check type and backflow preventer, double-check assemblies type.
- B. Field Quality Control Reports: For specified tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372, or to be certified in compliance with NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig.

2.3 VACUUM BREAKERS

- A. Vacuum Breakers, Pipe-Applied, Atmospheric Type:
 - 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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)

- b. Cash Acme Plumbing Products; an RWC brand
 - c. FEBCO; A WATTS Brand
 - d. WATTS; A Watts Water Technologies Company
 - e. Wilkins; Zurn Elkay
 - f. Zurn; Zurn Elkay
2. Description: Atmospheric vacuum breakers are designed for direct installation on piping to prevent backsiphonage by introducing air into the system when downstream pressure drops.
3. Standard: ASSE 1001.
4. Size: **NPS 1/4 to NPS 3**, as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Backflow Preventers, Reduced-Pressure-Principle Type:

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. Ames Fire & Waterworks; A Watts Water Technologies Company
 - b. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - c. Caleffi North America
 - d. FEBCO; A WATTS Brand
 - e. WATTS; A Watts Water Technologies Company
 - f. Wilkins; Zurn Elkay
2. Description: Reduced-pressure backflow preventers are intended for high-hazard applications. They contain two independently acting, spring-loaded check valves separated by a reduced-pressure zone that includes a relief valve force-loaded to the open position, allowing discharge to atmosphere if either check fails.
3. Standard: ASSE 1013.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: Maximum of 5 psig measured across the middle third of the flow range.
6. Size: On drawings.
7. Body: Bronze or stainless-steel for **NPS 2** and smaller; ductile or cast iron with interior lining that complies with AWWA C550 or that is FDA approved or stainless-steel for **NPS 2-1/2** and larger.
8. End Connections: Threaded for **NPS 2** and smaller; flanged for **NPS 2-1/2** and larger.
9. Configuration: Designed for horizontal, straight-through flow.
10. Accessories:
 - a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.

- b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
- c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 AUTOMATIC WATER SHUTOFF VALVE SYSTEMS

A. Shutoff Control Ball Valves and Actuators:

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. FloLogic, Inc.
 - b. MadisonWater
 - c. RectorSeal Plumbing; A CSW Industrials Company
 - d. WaterCop
 - e. WATTS; A Watts Water Technologies Company
2. Description: Shutoff control ball valves with actuators provide automatic or remote isolation of piping systems by rapidly opening or closing a quarter-turn ball valve in response to control or emergency signals.
3. Size: NPS 1-1/2.
4. Control Valve: Two-piece, full-port brass ball valve, MSS SP-110.
 - a. End Connections: Threaded, female.
 - b. Fittings: One **3/8-by-1/2-inch** male compression and one **3/8-by-1/2-inch** female compression.
 - c. Seats: PTFE.
 - d. O-Rings: FKM.
 - e. Stem: Low-lead brass. Blowout proof.
 - f. CWP Rating: 600 psig.
5. Manual-override control turn-knob for emergency operation of valve.
6. Valve Actuator: Motor operated, with or without gears, electric and electronic. Capable of closing valve against inlet pressure. Direct mount, fails closed.
 - a. Power Supply: 120 V ac with cord and plug.
 - b. Position Indicator: Standard.
7. Actuator Enclosure: Suitable for ambient conditions encountered by application.
8. Wireless Leak Detection System:
 - a. Detection: Provide each automatic water shutoff valve with a compatible wireless leak detection system to trigger valve actuation, selected to suit the specific application.
 - b. Sensor-Water Flow Type: Pipe mounted to detect water flow.
 - c. Sensor-Rope Type: Absorbent water-sensing rope constructed from twisted metal conductor wires insulated from one another and surrounded

by polyethylene mesh braid jacket to detect water presence.

- d. Wireless Signal Range: **100 ft.** minimum between sensors and receiver.
 - e. Self-monitoring enabled system; faults for lost communication between receiver and sensor(s).
 - f. Onboard Battery Backup: 48 hours of protection. Valve to close prior to backup failure.
 - g. LED Indicators: Wireless signal strength, communication loss, water fault, low-temperature fault, and low battery.
 - h. FCC-Approved Wireless Communication System: Between sensors, repeaters, and receivers.
 - i. Output Contacts: Interface with home security or BAS, cellular text notification service, or autodialer accessories.
 - j. Wireless Signal Repeater: Boosts signal performance between wireless sensors and receiver.
 - 1) Push-button pairing and unpairing, into and out of the network.
 - 2) Visual indication of wireless signal strength, low battery, and lost communication.
 - 3) Standard wall outlet, 120 V ac, power.
 - 4) Battery Backup: Two (2) AA batteries for battery backup to maintain system integrity during a power outage.
 - k. Wireless Water Switch: Allows manual override or wireless system functionality and closes the valve to shut off water flow.
 - l. Hard-Wired Water Switch: Allows manual override or wireless system functionality and closes the valve to shut off water flow.
9. Wired Leak Detection System:
- a. Detection: Provide each automatic water shutoff valve with a compatible wired leak detection system to trigger valve actuation, selected to suit the specific application.
 - b. Power Supply: Class II transformer with cord and plug, 120 V ac, UL listed.
 - c. Power Cord Length: 12 ft..
 - d. Control Panel: LED power and LED valves indicator.
 - e. Alarms: Audible alarm, with external output.
 - f. Output Contacts: Interface with home security or BAS, cellular text notification service, or autodialer accessories.
 - g. Wired Sensors:
 - 1) Quantity Per Receiver: One.
 - h. Cable Length: 100 ft..
 - i. Cable Adder: 100 ft. in length.

B. Accessories:

1. Electrical Plug Interrupter: Plugs into standard 120 V ac wall outlet.
2. Gas Flow Interrupter: ECO connector with female spade connectors. Factory prewired, **8 ft.**.
3. Gas Interface Cable: Interface cable with male and female connectors.
4. Step-Down Transformer: 120 V ac to 24 V ac with mounting plate, **12-ft.** plenum wire to power, and **8-ft.** plenum wire to sensor.
5. Liquid Level Sensors: Monitor fluid levels in addition to detecting plumbing leaks.
6. Autodialer: Send and receive automatic alerts when a fault condition occurs. Standard output contacts trigger up to nine predetermined telephone number calls.
 - a. Prerecord message for future playback.
 - b. 10-second recordable message.
 - c. Built-in tamper switch.
 - d. DC adaptor with battery backup.
 - e. Programmable as a silent (dialer only) or audible (siren and dialer) alarm.
 - f. Easy "Stop Call Sequence" - push "#" on phone to acknowledge the alarm and stop the dialing sequence.
7. Cellular Text Notification System:
 - a. Event SMS text notification to up to three cell phones.
 - b. Battery Backup: Four (4) AA batteries.
 - c. **12-ft.** interface cable to leak detection system.
 - d. Customized messaging.

2.6 BALANCING VALVES

A. Balancing Valves, Memory-Stop Type:

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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - b. Caleffi North America
 - c. Crane Fluid Systems; Crane Co.
 - d. Hammond Valve
 - e. Jenkins Valves; a Crane Co. brand
 - f. Milwaukee Valve Company
 - g. NIBCO INC.
 - h. Red-White Valve Corp.
 - i. Stockham; a Crane Co. brand
2. Description: Memory-stop balancing valves allow preset flow adjustment to be locked in and automatically returned after valve closure, enabling accurate system balancing while providing positive shutoff without disturbing the calibrated setting.

3. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
4. Pressure Rating: **400-psig** minimum CWP.
5. Size: **NPS 2** or smaller.
6. Body: Copper alloy.
7. Port: Standard or full port.
8. Ball: Chrome-plated brass or stainless-steel.
9. Seats and Seals: Replaceable.
10. End Connections: Solder joint or threaded.
11. Handle: Vinyl-covered steel with memory-setting device.

2.7 OUTLET BOXES

A. Outlet Boxes, Icemaker Type:

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. Accor Technology, Inc.
 - b. Guy Gray, IPS Corporation
 - c. LSP Products Group
 - d. Oatey Co.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Water-Tite, IPS Corporation
2. Description: Icemaker outlet boxes are recessed wall enclosures that provide a dedicated water supply connection and drain or containment area for refrigerator icemakers, offering a secure, accessible, and leak-resistant installation point that helps protect adjacent finishes from water damage.
3. Mounting: Recessed.
4. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
5. Faucet: Valved fitting complying with ASME A112.18.1-2024/CSA B125.1-2024. Include **NPS 1/2** or smaller copper tube outlet.
6. Accessory: Water-hammer arrestor.
7. Supply Shutoff Fitting: **NPS 1/2** gate, globe, or ball valve and **NPS 1/2** copper, water tubing.

2.8 WALL HYDRANTS

A. Wall Hydrants, Nonfreeze Type:

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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc

- d. Murdock Manufacturing; A Division of Morris Group International
 - e. Prier Products, Inc.
 - f. WATTS; A Watts Water Technologies Company
 - g. Woodford Manufacturing Company
 - h. Zurn; Zurn Elkay
- 2. Description: Nonfreeze wall hydrant is a freeze-resistant, wall-mounted water outlet designed with a self-draining valve located within the heated building envelope, preventing water from remaining in the exposed portion of the hydrant and protecting against freezing in cold climates.
 - 3. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
 - 4. Pressure Rating: **125 psig**.
 - 5. Operation: Loose key.
 - 6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 7. Inlet: **NPS 3/4 or NPS 1**.
 - 8. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 9. Box: Deep, flush mounted with cover.
 - 10. Box and Cover Finish: Polished nickel bronze.
 - 11. Outlet, Exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 12. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 - 13. Operating Keys(s): One with each wall hydrant.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arrester, Commercial, Piston Type:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. MIFAB, Inc
 - c. Precision Plumbing Products
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
- 2. Description: Sealed, water-hammer arrester designed to absorb hydraulic shock from quick-closing valves; maintenance-free unit suitable for potable water systems and continuous-pressure service.
- 3. Standard: ASSE/IAPMO/ANSI/CAN 1010 or PDI-WH 201.
- 4. Size: ASSE/IAPMO/ANSI/CAN 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER DEVICE

A. Trap-Seal Primer Device, Supply Type:

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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Precision Plumbing Products
 - e. ProFlo; a Ferguson Enterprises, Inc. brand
 - f. Sioux Chief Manufacturing Company, Inc.
 - g. WATTS; A Watts Water Technologies Company
 - h. Zurn; Zurn Elkay
2. Description: Supply-type trap-seal primer device automatically delivers a small amount of potable water from a supply line to maintain the water seal in floor drains and other trapped fixtures, preventing sewer gas infiltration during periods of infrequent use.
3. Standard: ASSE 1018.
4. Pressure Rating: **125 psig** minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: **NPS 1/2** threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: **NPS 1/2** threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.11 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer System, Commercial:

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. Precision Plumbing Products
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Zurn; Zurn Elkay
2. Description: Commercial trap-seal primer systems provide automatic, reliable replenishment of water seals in floor drains and other trapped fixtures throughout a facility, preventing sewer gas intrusion by maintaining trap seals during periods of low or intermittent use.
3. Standard: ASSE/ANSI 1044.
4. Inlet Size: **NPS 3/4, ASTM B88, Type L**; copper, water tubing.
5. Cabinet: Recessed -mounted steel box with stainless-steel cover.
6. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.

- 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.
7. Vacuum Breaker: ASSE 1001.
8. Number Outlets: Six.
9. Size Outlets: NPS 1/2.

2.12 FLEXIBLE CONNECTORS

A. Flexible Connector:

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. Flex-Hose Co., Inc
 - b. Mason Industries, Inc.
 - c. Metraflex Company (The)
2. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: Minimum 200 psig.
 - b. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 - c. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
3. Stainless-steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - a. Working-Pressure Rating: Minimum 200 psig.
 - b. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
 - c. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Vacuum Breakers: Install each vacuum breaker at required elevation above downstream outlets, protected from freezing and in accordance with manufacturer's instruction, applicable codes, and standards.
- B. Backflow Preventers: Install 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 unacceptable for this application.
3. Do not install bypass piping around backflow preventers.
- C. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- D. Water-Control Valves: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
- E. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.
- F. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
- G. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install **1-1/2-by-3-1/2-inch** fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install **1-1/2-by-3-1/2-inch** fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- J. Ground Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- K. Draining-Type Post Hydrants, Nonfreeze: Install with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- L. Yard Hydrants, Nonfreeze, Sanitary Type: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.
- M. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- N. Water-Hammer Arresters, Commercial, Piston Type: Install in water piping in

accordance with PDI-WH 201.

- O. Water-Hammer Arresters, Commercial, Diaphragm Type: Install in water piping in accordance with PDI-WH 201.
- P. Trap-Seal Primer Device, Supply Type: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- Q. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- R. Flexible Connector: Install without kinks or twists, independently supported from connected piping, accessible for inspection and replacement, and in accordance with manufacturer's instructions and applicable codes and standards.
- S. Water Meter: Install in accessible locations as approved by manufacturer, independently of piping with straight pipe lengths and isolation valves, protected for freezing or damage, and installed in accordance with manufacturer's instructions, utility requirements, and applicable codes and standards.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service, Including Testing: Engage a factory-authorized service representative to supervise field tests and inspect components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
 - 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.
- D. Water softeners will be considered defective if they do not pass tests and inspections and must be replaced by manufacturer.
- E. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal pumps, in-line, sealless.

B. Related Requirements:

1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.
2. Section 331113 "Potable Water Supply Wells" for well pumps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For pump controls.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which pumps will be attached.
2. Size and location of initial access modules for acoustical tile.

B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- C. Field Quality Control Reports: For specified tests and inspections.
- D. Qualification Statements: For testing agency and factory-authorized service representative.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized service representative who is trained and approved by manufacturer to perform manufacturer's field services and startup services.
- B. Testing Agency Qualifications: An independent agency qualified to perform specified field tests.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: UL 778 for motor-operated water pumps.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF/ANSI 61 and NSF/ANSI/CAN 372.

2.2 CENTRIFUGAL PUMPS

- A. Centrifugal Pumps, In-Line, Sealless:
 - 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. Flo Fab Inc
 - b. GRUNDFOS CBS Inc.
 - c. Taco Comfort Solutions
 - d. WILO USA LLC - WILO Canada Inc.
 - 2. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

3. Capacities and Characteristics: See drawings and manufacturer's model listed.
4. Pump Construction:
 - a. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - b. Minimum Working Pressure: 125 psig.
 - c. Maximum Continuous Operating Temperature: 220 deg F.
 - d. Casing: Stainless-steel, with threaded or companion-flange connections.
 - e. Impeller: Plastic composite or stainless-steel.
 - f. Motor: Three speed.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL PUMPS

- A. Comply with ANSI/HI 14.1-14.2.
- B. Mount pumps in orientation complying with manufacturer's written instructions.
- C. Pump Mounting:
 1. Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using vibration isolation type and deflection as specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of concrete base.
 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
 1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
 2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- E. Install pressure switches in water-supply piping.

- F. Install thermostats in hot-water return piping.
- G. Install timers in the utility room.
- H. Install time-delay relays in piping between water heaters and hot-water storage tanks.

3.2 INSTALLATION OF CONTROLS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between temperature controllers and devices.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Owner will engage a qualified testing agency to perform tests and inspections.
 - 2. Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation.
 - 1. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in "Piping Insulation Schedule, General" Article.
 - 2. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 221123.21

SECTION 22 13 13
FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure and pressure couplings.
 - 3. Cleanouts.
 - 4. Encasement for piping.
 - 5. Manholes.

1.03 SUBMITTALS

- A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.
- B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

1.04 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.

1.05 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 Program Manager no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Program Manager's written permission.

PART 2 - PRODUCTS

2.01 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

- A. Ductile Iron Pipe: ASTM A 746, A-21.11 for push-on joints. All pipe and fittings shall be cement mortar lined, and shop painted inside and out, with one coat of bituminous coating at least 1 mil thick. Pressure class 350 or thickness class 51.
- B. Gaskets: A.S.A 21.11, latest revision, rubber.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC Pipe: ASTM D-3034 and ASTM D-3212, latest revision, SDR 35 or SDR 26.
- B. Flexible elastomeric seals: ASTM D-3212, latest revision.

2.03 CLEANOUTS

- A. Cast-Iron Cleanouts:
 1. 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.
 2. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.04 MANHOLES

- A. Manholes shall be pre-cast concrete with cast-iron frames and covers as shown per the Town of Century.

2.05 CONCRETE

- A. General: Cast-in-place concrete complying with 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: 0.10' drop across manhole where there is not a turn greater than 22° and a 0.25' drop where turn is greater than 22°.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 2H:IV min.
- 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.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer 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 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. 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, at minimum slope of 1 percent unless otherwise indicated.

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.
 4. Install ductile-iron, gravity sewer piping according to ASTM A 746.
- G. 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.

3.03 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:

3.04 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. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 12 inches above finished surface elsewhere unless otherwise indicated.
- E. Install manhole-cover inserts in frame and immediately below cover.

3.05 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.06 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 use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use Heavy-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 2. Use Heavy-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 4 inches deep. Set with tops flush with surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.07 CONNECTIONS

- A. 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. 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.

3.08 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
 1. Remove manhole and close open ends of remaining piping.
 2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.09 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.010 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. Damage: 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.
 - 4. Submit separate report for each test.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- E. MANHOLE TESTING:
 - 1. All new manholes shall be tested by the Contractor using the vacuum test method, following the manufacturer's recommendations for proper and safe procedures.
 - 2. Any leakage in the manhole or structure, before, during, or after the test shall be repaired.
 - 3. All pipes for vacuum testing entering the manhole shall be installed at the top access point of the manhole.
 - 4. A vacuum of 10 inches of mercury (Hg) (5.0 psi) shall be drawn on the manhole, and the time shall be measured for the vacuum to drop to 9 inches of mercury (Hg) (4.5).
 - 5. Manholes will be considered to have failed the vacuum test if the time to drop 1 inch of mercury is less than what is shown in the following table:

VACUUM TEST TIMETABLE Manhole Diameter

Depth (ft.)	48 inches	60 inches	72 inches	96 inches
4	10 sec.	13 sec.	16 sec.	19 sec.
8	20 sec.	26 sec.	32 sec.	38 sec.
12	30 sec.	39 sec.	48 sec.	57 sec.
16	40 sec.	52 sec.	64 sec.	76 sec.
20	50 sec.	65 sec.	80 sec.	95 sec.
+ Each 2 ft.	+ 5 sec.	+ 6.5 sec.	+ 8 sec.	+9.5 sec.

F. PIPELINE TESTING

- 1. All pipelines shall be tested in accordance with procedures and practices applicable to the various types and kinds of pipe and to the various sizes of pipe. The Contractor is reminded that personnel not experienced in testing procedures and practices, and particularly in air-testing of pipelines, should neither be allowed to conduct the test nor assist in the test procedures.

G. Testing Gravity Sewers:

1. The total quantity of infiltration into the sewer (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter per 24 hours and in no case shall it exceed 2,500 gallons per mile per 24 hours. Regardless of the amount of infiltration leakage which occurs, the Contractor shall repair and correct any and all visible or audible leaks in any section of the sewer, manholes, or appurtenances.
2. In order that final testing of the sewers not be deferred until the sewers are operating under 'wet weather' and high water table conditions, and that surface restoration work can closely follow construction work, the Contractor shall employ the "low-pressure air testing procedure" in order to determine the probable acceptability of the sewers as reasonably watertight conduits (within the limits specified) when operating under 'wet weather' and high water table conditions.
3. Sewers of sizes up to and including 24" in diameter shall be tested by use of the Low-Pressure Air Test of Sewer Lines, ASTM C828, latest revision.
4. The "low-pressure air test" shall generally conform to the hereinafter outlined procedure, recommended by the National Clay Pipe Institute for testing sanitary sewers.
 - a. Clean pipe to be tested. For small diameter sewers this may be done by "balling" the line, that is, utilizing water pressure for propelling a rubber ball through the sewer; and, in the case of larger diameter sewers, the Contractor may elect to employ interior cleaning crews. A wetted interior pipe surface will be advantageous in securing more consistent results.
 - b. Plug all open ends and pipe outlets with suitable test plugs, and brace each plug securely. Brace all plugged fittings and plugged service lines to prevent blow-out of plug.
 - c. If the pipe to be tested is subject to external pressure exerted by elevation of ground water table, the elevation of ground water table (with reference to invert of sewer) shall be determined. This may be done by either of the following methods:
 - 1) Insert a pipe probe through backfill to elevation of invert by boring or jetting. Equip top end of probe with a bubbler head. Slowly pass air through bubbler head and probe. Read pressure from air gauge mounted on bubbler head. All base gage pressures specified for the test shall be increased by gage reading. Gage shall be low-pressure, wide range.
 - 2) Install ½ inch diameter pipe through manhole wall at level approximately at top of sewer; turn down pipe outside of manhole to run to elevation of invert; and cap pipe inside of manhole. This should be done at the time when the manhole is constructed. When the line is to be tested remove cap, clear test pipe with compressed air, and connect clear plastic tube to test pipe. Start flow of water through pipe and tube, and read elevation of water in tube (with reference to invert of pipe). Divide reading by 2.31 and add resulting to invert of pipe). Divide reading by 2.31 and add resulting pressure (in psi) to add base gage pressures specified for the test. After all testing has been completed cap or plug test pipe at manhole wall.
 - d. Add air slowly to the plugged section of the sewer under test until the internal air pressure has been raised to 4.0 psig base plus any pressure allowance representing external head as determined under 4.c. hereinabove. After the pre-set pressure (4.0 psig base + allowance) has been obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain the pre-set pressure, then close air supply valve.
 - e. When the pressure decreases to a gage reading equal to 3.5 psig base + allowance (such gage reading being termed stabilized pressure), start stopwatch. Determine time in seconds marking drop of 1.0 psig of internal air pressure.

- f. Refer to the AIR TEST TABLE following this Section to determine minimum permissible pressure holding time in seconds for particular section of sewer being tested.
5. The Contractor shall be responsible for observance of all safety precautions and maintenance of safe conditions during air testing.
 - a. These precautions shall include but not be limited to ensuring that personnel not experienced in air testing procedure not be allowed to conduct the air tests and that personnel are not allowed in the manholes at ends of test sections during tests.
 - b. Pneumatic plugs shall be seal tested in pipe sections outside of trench before being used to plug sewers; and such test sections shall be internally pressurized to levels adequate to determine sealing efficiency of plugs.
 - c. Air supply lines to pneumatic plugs and to sealed section shall be equipped with pressure regulating sets. Return line from sealed section shall be equipped with pressure gage to monitor pressure rise in sealed section.

AIR TEST TABLES*

MINIMUM HOLDING TIME IN SECONDS

REQUIRED FOR PRESSURE TO DROP FROM 3½ TO 2½ PSIG

PIPE SIZE														
LF	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	33"	36"	39"
25	4	10	18	28	40	62	89	121	158	200	248	299	356	418
50	9	20	35	55	79	124	178	243	317	401	495	599	713	837
75	13	30	53	83	119	186	267	364	475	601	743	898	1020	1105
100	18	40	70	110	158	248	356	485	634	765	851	935		
125	22	50	88	138	198	309	446	595	680					
150	26	59	106	165	238	371	510							
175	31	69	123	193	277	425								
200	35	79	141	220	317									
225	40	89	158	248	340									
250	44	99	176	275										
275	48	109	194	283										
300	53	119	211											
350	62	139	227											
400	70	158												
450	70	170												
500	88													
550	70													
600	106													

Note: To be used when testing one diameter only.

3.011 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-iron sanitary waste and vent pipe and fittings.
2. PVC sanitary waste and vent pipe and fittings.
3. Sanitary waste and vent specialty pipe fittings.
4. Encasement for underground metal piping.

B. Related Requirements:

1. Section 220533 "Heat Tracing for Plumbing Piping" for heat tracing.
2. Section 220719 "Plumbing Piping Insulation" for piping insulation.
3. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
4. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.
5. Section 333115 "Site Sanitary Sewerage Piping" for sanitary sewerage piping and structures outside the building.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

C. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is

based and their installation requirements.

- C. Field Quality Control Reports: For specified tests and inspections.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste 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 in accordance with requirements indicated:
 - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's Representative's written permission.

1.5 WARRANTY

- A. Special Warranty: Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Components and installation are capable of withstanding the following minimum working pressure requirements unless otherwise indicated:
 - 1. Sanitary Waste and Vent Piping: 10 ft. head of water.
 - 2. Sanitary Waste, Force-Main Piping: 50 psig.

2.2 SANITARY WASTE AND VENT PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 CAST-IRON SANITARY WASTE AND VENT PIPE AND FITTINGS

- A. Sanitary Waste and Vent Pipe Coupling, Hubless - Standard:
 - 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. ANACO-Husky; a part of the McWane family of companies
 - b. Charlotte Pipe and Foundry Company
 - c. Dallas Specialty & Mfg. Co.
 - d. Fernco Inc
 - e. Ideal Tridon Group
 - f. Matco-Norca
 - g. MIFAB, Inc
 - h. Mission Rubber Company, LLC
 - i. Tyler Pipe; a part of the McWane family of companies
2. Standards:
 - a. ASTM C1277.
 - b. CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C564 rubber sleeve with integral, center pipe stop.

2.4 COPPER SANITARY WASTE AND VENT TUBE AND FITTINGS

- A. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.

2.5 ABS SANITARY WASTE AND VENT PIPE AND FITTINGS

- A. Solvent Cement: ASTM D2235.
 1. Verify ABS solvent cement has a VOC content of 325 g/L or less.
 2. Verify solvent cement complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.6 PVC SANITARY WASTE AND VENT PIPE AND FITTINGS

- A. Sanitary Waste and Vent Pipe, PVC:
 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. Charlotte Pipe and Foundry Company
 - b. Cor-Tek; Atkore International
 - c. JM Eagle
 - d. National Pipe & Plastics; a CRH Company
 - e. Silver-line Plastics
 - f. Westlake Pipe & Fittings

2. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.
3. Solid Wall: ASTM D2665 drain, waste, and vent.
4. Cellular Core: ASTM F891, Schedule 40.

B. Sanitary Waste and Vent Fittings, PVC:

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. Charlotte Pipe and Foundry Company
 - b. Mueller Streamline Co.; a company of Mueller Industries
 - c. NIBCO INC.
 - d. Westlake Pipe & Fittings
2. PVC Socket Fittings: ASTM D2665, manufactured in accordance with ASTM D3311; drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F656.

1. Verify adhesive primer has a VOC content of 550 g/L or less.
2. Verify adhesive primer complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

D. Solvent Cement: ASTM D2564.

1. Verify PVC welding solvent cement has a VOC content of 510 g/L or less.

2.7 SANITARY WASTE AND VENT SPECIALTY PIPE FITTINGS

A. Sanitary Waste and Vent Piping Transition Coupling:

1. Description: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Transition Coupling - Fitting-Type: Manufactured piping coupling or specified piping system fitting.

B. Sanitary Waste and Vent Piping Transition Coupling - Pressure:

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. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - b. Cascade Waterworks Mfg. Co.
 - c. EBAA Iron Sales, Inc.
 - d. Ford Meter Box Company, Inc. (The)
 - e. JCM Industries, Inc
 - f. Romac Industries, Inc.
2. Standard: AWWA C219.
3. Description: Metal sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
4. Center-Sleeve Material: Manufacturer's standard.
5. Gasket Material: Natural or synthetic rubber.
6. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.1 INSTALLATION OF SANITARY WASTE AND VENT PIPING, GENERAL

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

- K. Make changes in direction for sanitary waste and vent piping using appropriate branches, bends, and long-sweep bends.
1. Sanitary tees and short-sweep one-fourth bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 2. Use long-turn, double Y-branch, and one-eighth-bend fittings if two fixtures are installed back to back or side by side with common drainpipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - b. Do not change direction of flow more than 90 degrees. Use the proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of sanitary waste piping in direction of flow is prohibited.
- L. Lay buried building sanitary waste piping beginning at low point of each system.
1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 3. Maintain swab in piping and pull past each joint as completed.
- M. Slope: Install sanitary waste and vent piping at the following minimum slopes unless otherwise indicated on Drawings:
1. Building Sanitary Waste Piping: Two percent downward in direction of flow for piping **NPS 3** and smaller; 1 percent downward in direction of flow for piping **NPS 4** and larger.
 2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
 3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.
- N. Install engineered sanitary waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 (Historical) and hubless, single-stack drainage fitting manufacturer's written installation instructions.
 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- O. Install force mains at elevations indicated.
- P. Install heat tracing on grease waste piping.
1. Install heat tracing in accordance with Section 220533 "Heat Tracing for Plumbing Piping."
- Q. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.

- a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
4. Install piping and cleanouts to grease interceptors.
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
 1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
 1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- V. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.2 INSTALLATION OF CAST-IRON SANITARY WASTE AND VENT PIPE AND FITTINGS

- A. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A21.5.
- B. Joint Construction:
 1. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 2. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked

- joints.
3. Hubless, Cast-Iron Soil Piping Coupled Joints: Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.3 INSTALLATION OF PVC SANITARY WASTE AND VENT PIPE AND FITTINGS

- A. Install aboveground PVC piping in accordance with ASTM D2665.
- B. Install underground PVC piping in accordance with ASTM D2321.
- C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

3.4 INSTALLATION OF SANITARY WASTE AND VENT SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. Install transition couplings at joints of piping with small differences in ODs.
 2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
 4. In Underground Force Main Piping:
 - a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 - b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

3.5 INSTALLATION OF VALVES

- A. General valve installation requirements for general-duty valve installation are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
 1. Install shutoff valve on each sewage pump discharge.
 2. Install full-port ball valve for piping **NPS 2** and smaller.
 3. Install gate valve for piping **NPS 2-1/2** and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated in Shop Drawings.
 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater

- valve.
- 3. Install backwater valves in accessible locations.
- 4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 6. Install individual, straight, horizontal piping runs:
 - a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52 spring hangers.
- C. Metal Tube/Pipe:
 - 1. Install hangers with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and requirements of authorities having jurisdiction, whichever are most stringent.
 - 2. Support vertical runs to comply with MSS SP-58, locally enforced codes, and requirements of authorities having jurisdiction, whichever are most stringent.
- D. Plastic Pipe:
 - 1. Install hangers with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and requirements of authorities having jurisdiction, whichever are most stringent.
 - 2. Support vertical runs to comply with manufacturer's written instructions, locally enforced codes, and requirements of authorities having jurisdiction, whichever are most stringent.

- E. Support horizontal piping and tubing within **12 inches** of each fitting, valve, and coupling.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test sanitary waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than **10 ft. head of water**.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of **1 inch wg**.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this

- pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 2. Cap and subject piping to static-water pressure of **50 psig** above operating pressure, without exceeding pressure rating of piping system materials.
 - a. Isolate test source and allow to stand for four hours.
 - b. Leaks and loss in test pressure constitute defects that must be repaired.
 - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 4. Prepare reports for tests and required corrective action.
- F. Test grease waste piping and heat trace wiring.

3.8 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated in Shop Drawings.
- B. Aboveground, sanitary waste piping **NPS 4** and smaller is to be the following:
 - 1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack drainage fittings; hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
 - 5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 8. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, sanitary waste piping **NPS 5** and larger is to be the following:
 - 1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack drainage

- fittings; hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
 - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping **NPS 4** is to be the following:
- 1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; standard hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
 - 5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Drawn-temper copper tube, **Type M**; copper pressure fittings; and soldered joints.
 - 6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 8. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping **NPS 5** and larger is to be the following:
- 1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; standard hubless-piping couplings; and coupled joints.
 - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- F. Underground, sanitary waste and vent piping **NPS 4** and smaller are to be the following:
- 1. Extra-heavy cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; standard hubless-piping couplings; and coupled joints.
 - 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, sanitary waste piping **NPS 5** and larger is to be the following:
- 1. Extra-heavy, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; standard hubless-piping couplings; coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

- H. Aboveground sanitary-sewage force mains **NPS 1-1/2 and NPS 2** are to be the following:
1. Drawn-temper copper tube, **Type L**; copper pressure fittings; and soldered joints.
 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- I. Aboveground sanitary-sewage force mains **NPS 2-1/2 to NPS 6** are to be the following:
1. Drawn-temper copper tube, **Type L**; copper pressure fittings; and soldered joints.
 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
 3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe fittings; and grooved joints.
- J. Underground sanitary-sewage force mains **NPS 4** and smaller are to be the following:
1. Drawn -temper copper tube, **Type L**; wrought- copper pressure fittings; and soldered joints.
 2. Ductile-iron, mechanical-joint piping and mechanical joints.
 3. Ductile-iron, push-on-joint piping and push-on joints.
 4. Ductile-iron, grooved-joint piping and grooved joints.
 5. Fitting-type transition coupling for piping smaller than **NPS 1-1/2** and pressure transition coupling for **NPS 1-1/2** and larger if dissimilar pipe materials.
- K. Underground sanitary-sewage force mains **NPS 5** and larger are to be the following:
1. Drawn-temper copper tube, **Type L**; wrought- copper pressure fittings; and soldered joints.
 2. Ductile-iron, mechanical-joint piping and mechanical joints.
 3. Ductile-iron, push-on-joint piping and push-on joints.
 4. Ductile-iron, grooved-joint piping and grooved joints.
 5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts, stainless-steel, exposed, floor mounted.
2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
2. Section 077200 "Roof Accessories" for preformed flashings.
3. Section 078400 "Firestopping" for through-penetration firestop assemblies.
4. Section 221323 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.
5. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
6. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
7. Section 334200 "Stormwater Conveyance" for storm drainage piping and piping specialties outside the building.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:

1.3 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: For specified tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties.

PART 2 - PRODUCTS

2.1 ASSEMBLY REQUIREMENTS

- A. Provide sanitary waste piping specialties bearing label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

- A. Cleanouts, Stainless-steel, Exposed, Floor Mounted:
 - 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. BLÜCHER; A Watts Water Technologies Company
 - b. Josam Company
 - c. Kusel Equipment Co
 - d. Zurn; Zurn Elkay
 - 2. Standards: ASME A112.3.1; NSF listed.
 - 3. Size: Same as connected branch.
 - 4. Housing: Type 304 stainless-steel.
 - 5. Closure: Stainless-steel with seal.
 - 6. Riser: ASTM A74, Extra-Heavy Class, stainless-steel drainage pipe fitting and riser to cleanout.
 - 7. Body or Ferrule: Stainless-steel.
 - 8. Clamping Device: Required.
 - 9. Outlet Connection: Inside caulk.
 - 10. Adjustable Housing Material: Cast iron with threads.
 - 11. Frame and Cover Material and Finish: Stainless-steel.
 - 12. Frame and Cover Shape: Round.
 - 13. Top-Loading Classification: Extra Heavy Duty.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Deep-Seal Traps:
 - 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2 (DN 50): **4-inch-** minimum water seal.
 - b. NPS 2-1/2 (DN 65) and Larger: **5-inch-** minimum water seal.
- B. Floor Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with **NPS 1/2** side inlet.

PART 3 - EXECUTION

3.1 INSTALLATION OF CLEANOUTS

- A. Install cleanouts in aboveground piping and building drain piping in accordance with the following, unless otherwise indicated:
 1. Size same as drainage piping up to **NPS 4**. Use **NPS 4** for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of **50 ft.** for piping **NPS 4** and smaller and **100 ft.** for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

3.2 INSTALLATION OF MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Deep-Seal Traps: Install deep-seal traps on floor drains and other waste outlets, as indicated in the floor drain schedule.
- B. Floor Drain, Trap-Seal Primer Fittings: 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.
- C. Blocking: Install blocking reinforcement for wall-mounting-type specialties.
- D. Traps, General: Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Floor sinks.
- B. Related Requirements:
 - 1. Section 033000 "Cast-In-Place Concrete" for placing concrete at concrete trench drain-forming system.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sanitary drains are to bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

- A. Floor Drain - Cast Iron:
 - 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. Josam Company
 - b. MIFAB, Inc
 - c. Prier Products, Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Wade; a subsidiary of Zurn Water Solutions
 - f. WATTS; A Watts Water Technologies Company
 - g. Whitehall Manufacturing; a division of Morris Group International
 - h. Zurn; Zurn Elkay

2. Source Limitations: Obtain cast-iron floor drains from single manufacturer.
3. Standard: ASME A112.6.3 with backwater valve.
4. Pattern: Floor drain.
5. Body Material: Cast iron.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Outlet: Bottom.
10. Connection: No hub.
11. Backwater Valve: Drain-outlet type.
12. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
13. Sediment Bucket: Not required.
14. Top or Strainer Material: Stainless-steel.
15. Top of Body and Strainer Finish: Nickel bronze.
16. Top Shape: Round.
17. Top Loading Classification: Extra Heavy Duty.
18. Funnel: Not required.
19. Inlet Fitting: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
20. Trap Material: Bronze.
21. Trap Pattern: Deep-seal P-trap.
22. Trap Features: Trap-seal primer valve drain connection.

2.3 FLOOR SINKS

A. Floor Sink - Cast Iron:

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. Commercial Enameling Company
 - b. Jay R. Smith Mfg Co; a division of Morris Group International
 - c. Josam Company
 - d. MIFAB, Inc
 - e. Wade; a subsidiary of Zurn Water Solutions
 - f. WATTS; A Watts Water Technologies Company
 - g. Zurn; Zurn Elkay
2. Source Limitations: Obtain cast-iron floor sinks from single manufacturer.
3. Standard: ASME A112.6.7.
4. Pattern: Floor drain.
5. Body Material: Cast iron.
6. Anchor Flange: Required, with seepage holes.
7. Clamping Device: Required.
8. Outlet: Bottom, no-hub connection.
9. Coating on Interior Surfaces: Acid-resistant enamel.
10. Sediment Bucket: Not required.
11. Internal Strainer: Dome.
12. Internal Strainer Material: Aluminum.

13. Top Grate Material: Cast iron, loose.
14. Top of Body and Grate Finish: Nickel bronze.
15. Top Shape: Square.
16. Top Loading Classification: No traffic.
17. Funnel: Required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FLOOR DRAINS

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than **1/4-inch** total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than **1-inch** total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated in a schedule or on Drawings.

3.2 INSTALLATION OF FLOOR SINKS

- A. Install floor sinks where indicated on Drawings. Set grates of drains flush with finished floor.
 1. Position floor sinks for easy access and maintenance.
 2. Install floor sink flashing collar or flange, so that no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 3. Install individual traps for floor sinks connected to sanitary building drain, unless otherwise indicated in a schedule or on Drawings.

END OF SECTION 221319.13

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, gas-fired, storage, domestic-water heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: For energy efficiency.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source Quality Control Reports: For fuel-fired, domestic water heaters.

F. Field Quality Control Reports: For specified tests and inspections.

- G. Qualification Statements: For testing agency and factory-authorized service representative
- H. Sample Warranties: For specified special warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized service representative who is trained and approved by manufacturer to perform manufacturer's field services and demonstration services.
- B. Testing Agency Qualifications: An independent agency qualified to perform specified field tests.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year(s).
 - b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
 - 1) Heat Exchanger: Three years.
 - 2) Controls and Other Components: One year(s).
 - 3) Separate Hot-Water Storage Tanks: Three years.
 - c. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
 - 1. Water Heater Efficiency: Comply with efficiency requirements in IgCC, which supersede requirements in ASHRAE/IES 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heater:
 - 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. A. O. Smith Corporation
 - b. American Water Heaters
 - c. Bradford White Corporation
 - d. Raypak; a Rheem brand
 - e. Rheem Manufacturing Company
 - f. State Water Heaters
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.10.3/CSA 4.3.
 - 4. Storage-Tank Construction: Non- 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) NPS 2 (DN 50) and Smaller: Threaded ends in accordance with

- ASME B1.20.1.
- 2) NPS 2-1/2 (DN 65) and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless-steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
- c. Lining: Glass complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. 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 working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
- 6. Special Requirements: NSF 5 construction.
- 7. Power-Vent System: Exhaust fan, interlocked with burner.
- B. Capacity and Characteristics: See drawings.
 - 1. Minimum Vent Diameter: 3 inches.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than **NPS 3/4** with ASME B1.20.1 pipe threads.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
- C. Heat-Trap Fittings: ASHRAE 90.2.

- D. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and memory-stop balancing valves to provide balanced flow through each domestic-water heater.
- E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.
- M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-

half times pressure rating before shipment.

- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF FUEL-FIRED, DOMESTIC-WATER HEATERS

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Gas-Fired, Domestic-Water Heaters: Install in accordance with NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and

automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

- D. Oil-Fired, Domestic-Water Heaters: Install in accordance with NFPA 31.
 - 1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 231113 "Facility Fuel-Oil Piping."
- E. Gas and Oil-Fired, Domestic Water Heaters: Install in accordance with NFPA 31 and NFPA 54.
 - 1. Install both types in accordance with manufacturer's listed instructions, with unlisted units requiring a minimum **12-inch** clearance on all sides and rear, and combustible floors protected accordingly. Ignition sources in garage installations must be elevated at least **18 inches** above the floor unless the unit is listed as flammable vapor ignition resistant. All units require a listed temperature and pressure relief (TPR) valve with no shutoff valve between the relief valve and the tank, plus overtemperature protection.
- F. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" and Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- G. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-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.
- H. Install combination temperature-and- pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-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.
- I. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- J. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."
- K. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

- L. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- M. Fill domestic-water heaters with water.
- N. Charge domestic-water expansion tanks with air to required system pressure.
- O. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water will contain less than 0.25 percent of lead by weight.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency:
 - 1. Owner will engage a qualified testing agency to perform tests and inspections.
 - 2. Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 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 operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters. Training will be a minimum of one hour(s).

END OF SECTION 223400

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial lavatories.
2. Commercial showers.
3. Commercial sinks.
4. Commercial urinals.
5. Commercial water closets.
6. Commercial wash fountains.
7. Toilet seats.
8. Fixture carriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include construction details, material descriptions and thicknesses, dimensions of individual components and profiles, and finishes for plumbing fixtures.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Plans, elevations, sections, and mounting details.
2. Details of equipment assemblies, including accessories. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, location and size of each field connection, location and size of each cutout, and anchorage provisions and attachment methods. Indicate coordination requirements for adjacent and interfacing Work.
3. Diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: For water consumption.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories and/or counter-mounted sinks.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For lavatories and faucets.
 - a. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1) Servicing and adjustments of automatic faucets.
2. For shower valves to include in maintenance manuals.
3. For sinks and faucets to include in operation and maintenance manuals.
 - a. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1) Servicing and adjustments of automatic faucets.
4. For flushometer valves and electronic sensors to include in operation and maintenance manuals.
5. For wash fountains and components to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Lavatory faucets, sink faucets, shower valves, and wash fountain spray heads and faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COMMERCIAL LAVATORIES

A. Lavatories, Counter Mounted:

1. Lavatory, Counter Mounted - Vitreous China, Self-Rimming, Oval or Round:
 - 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) American Standard
- 2) Briggs Plumbing Products, Inc
- 3) Gerber Plumbing Fixtures LLC.
- 4) Kohler Co
- 5) Mansfield Plumbing Products LLC
- 6) ProFlo; a Ferguson Enterprises, Inc. brand
- 7) Sloan Valve Company
- 8) TOTO USA, INC
- 9) Zurn; Zurn Elkay

b. Fixture:

- 1) Standard: ASME A112.19.2/CSA B45.1.
- 2) Type: Self-rimming for above-counter mounting.
- 3) Nominal Size:
 - a) Round, 19 inches.
- 4) Faucet-Hole Punching: Three holes, 2-inch centers.
- 5) Faucet-Hole Location: Top.
- 6) Color: White.
- 7) Mounting Material: Sealant.

c. Faucet: Gooseneck, brass, battery operated, sensor faucet with ASSE mixing valve.

B. Lavatories, Wall Mounted:

1. Lavatories, Wall Mounted - Vitreous China, Rectangular with Ledge Back:

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) American Standard
- 2) Briggs Plumbing Products, Inc
- 3) Gerber Plumbing Fixtures LLC.
- 4) Kohler Co
- 5) Mansfield Plumbing Products LLC
- 6) ProFlo; a Ferguson Enterprises, Inc. brand
- 7) Sloan Valve Company
- 8) TOTO USA, INC

b. Fixture:

- 1) Standard: ASME A112.19.2/CSA B45.1.
- 2) Type: For wall hanging.
- 3) Nominal Size: Rectangular, 19 by 17 inches.
- 4) Faucet-Hole Punching: Three holes, 2-inch centers.
- 5) Faucet-Hole Location: Top.
- 6) Color: White.

- 7) Mounting Material: Chair carrier.
 - c. Faucet: Gooseneck, brass, battery operated, sensor faucet with ASSE mixing valve.
 - d. Support: Lavatory carrier, floor affixed with steel uprights concealed arm.
 - e. Lavatory Mounting Height: Accessible in accordance with ICC A117.1.
- C. Lavatories, Freestanding:
- D. Lavatory Systems:
- E. Lavatory Faucets, Automatically Operated:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advanced Modern Technologies Corporation - AMTC
 - b. American Standard
 - c. Bradley Corporation
 - d. Chicago Faucets; Geberit Group
 - e. Delta Faucet Company
 - f. Elkay
 - g. Hydrotek International, Inc.
 - h. Just Manufacturing
 - i. Kohler Co
 - j. Krowne
 - k. Moen Incorporated
 - l. ProFlo; a Ferguson Enterprises, Inc. brand
 - m. Sloan Valve Company
 - n. Speakman Company
 - o. Stern Engineering Ltd.
 - p. T&S Brass and Bronze Works, Inc.
 - q. TOTO USA, INC
 - r. Whitehall Manufacturing; a division of Morris Group International
 - s. Zurn; Zurn Elkay
 - 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 - 3. Operation Type: Battery powered electronic sensor operated, mixing.
 - 4. 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.
 - 5. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 6. Body Type: Three hole.
 - 7. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
 - 8. Finish: Polished chrome plate.

9. Maximum Flow Rate: 0.5 gpm.
10. Mounting Type: Deck, concealed.
11. Spout: Rigid, gooseneck type.
12. Spout Outlet: Aerator.
13. Drain: Not part of faucet.

F. Lavatory Supply Fittings:

1. NSF Standards: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
4. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key.
 - a. Risers Size: NPS 3/8.
 - b. Risers Material: ASME A112.18.6/CSA B125.6, braided or corrugated stainless-steel, flexible hose.

G. Lavatory Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with **NPS 1-1/4** offset and straight tailpiece.
3. Trap:
 - a. Size: NPS 1-1/2 by NPS 1-1/4.
 - b. Material:
 - 1) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 - 2) Stainless-steel, two-piece trap and swivel elbow with **0.012-inch** thick stainless-steel tube to wall, and stainless-steel wall flange.

2.3 COMMERCIAL SHOWERS

A. Shower Valve Assemblies:

1. Shower Valve Assemblies - Single-Handle, Thermostatic/Pressure-Balancing Mixing Valve with Head:
 - 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) Chicago Faucets; Geberit Group
 - 2) Lawler Manufacturing Company, Inc
 - 3) POWERS; A Watts Water Technologies Company
- b. Source Limitations: Obtain shower heads and shower valves from single source from single manufacturer.
- c. Description: Single-handle, accessible, thermostatic/pressure-balancing mixing valve with hot- and cold-water indicators; diverting valve check stops; and hose with handheld shower head on sliding rod shower head.
- d. Shower Valve:
- 1) Standards:
 - a) ASME A112.18.1/CSA B125.1.
 - b) ASSE 1016/ASME A112.1016/CSA B125.16.
 - 2) Body Material: Solid brass.
 - 3) Finish: Polished chrome plate.
 - 4) Mounting: Concealed.
 - 5) Operation: Single-handle, push-pull or twist or rotate control.
 - 6) Antiscald Device: Integral with mixing valve.
 - 7) Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
- e. Supply Connections: **NPS 1/2**.
- f. Shower Head:
- 1) Standard: ASME A112.18.1/CSA B125.1.
 - 2) Type: Ball joint with arm and flange.
 - 3) EPA WaterSense: Required.
 - 4) Shower Head Maximum Flow Rate: 2.0 gpm.
 - 5) Shower Head Material: Metallic with chrome-plated finish.
 - 6) Spray Pattern: Fixed.
 - 7) Integral Volume Control: Not required.
 - 8) Temperature Indicator: Not required.

B. Shower Basins:

1. Shower Basins - Precast Terrazzo:

- 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) Fiat Products
 - 2) Florestone Products Co., Inc.
 - 3) Stern-Williams Products, LLC.
- b. Source Limitations: Obtain shower basins from single source from single manufacturer.
- c. Description: Precast-terrazzo base for built-up-type shower fixture.

- d. Standard: CSA B45.8/IAPMO Z403.
- e. Type: Accessible in accordance with ICC A117.1.
- f. Nominal Size and Shape: 42 by 34 to 36 inches rectangular.
- g. Color: White.
- h. Outlet: Drain with NPS 2 outlet; lip drain outside shower in accordance with ADA-ABA.

C. Grout:

- 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- 2. Characteristics: Nonshrink; recommended for interior and exterior applications.
- 3. Design Mix: **5000 psi**, 28-day compressive strength.
- 4. Packaging: Premixed and factory packaged.

2.4 COMMERCIAL SINKS

A. Service Sinks, Floor Mounted:

- 1. Service Sinks, Floor Mounted - Molded Stone:
 - 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) Fiat Products
 - 2) Florestone Products Co., Inc.
 - b. Source Limitations: Obtain sinks from single source from single manufacturer.
 - c. Fixture:
 - 1) Standard: ASME A112.18.2/CSA B125.2.
 - 2) Shape: Square.
 - 3) Nominal Size: 24 by 24 inches.
 - 4) Height: 10 inches.
 - 5) Rim Guard: On all top surfaces.
 - 6) Color: Not applicable.
 - 7) Drain: Grid with NPS 2 outlet.
 - d. Mounting: On floor and flush to wall.
 - e. Faucet: Manual type, two handle, ASME a112.18.1/CSA B125.1, commercial solid brass, hose connection spout, swinging.

B. Handwash Sinks:

- 1. Handwash Sinks - Stainless-steel:
 - 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) Advance Tabco
- 2) AERO Manufacturing Company
- 3) Amtekco Industries, Inc; a Wasserstrom Company
- 4) Eagle Group
- 5) Elkay
- 6) Griffin Products, Inc.
- 7) Just Manufacturing
- 8) Krowne
- 9) Metcraft Industries, Inc.
- 10) Sloan Valve Company

b. Source Limitations: Obtain sinks from single source from single manufacturer.

c. Fixture:

1) Standards:

- a) ASME A112.19.3/CSA B45.4.
- b) NSF 61.

2) Type: Wall-mounted stainless-steel basin with radius corners, back for faucet, and support brackets.

3) Overall Dimensions: 17 by 16 by 5 inches.

4) Material: 18 gauge, Type 304 stainless-steel.

d. Faucet: Manual, commercial brass, two handle faucet with swinging gooseneck spout.

e. Supply Fittings: Comply with requirements in "Sink Supply Fittings" Paragraph.

f. Waste Fittings: Comply with requirements in "Sink Waste Fittings" Paragraph.

g. Support: Sink carrier, floor affixed with steel uprights.

h. Mounting Height: Accessible in accordance with ICC A117.1.

C. Sink Supply Fittings:

1. NSF Standards: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
4. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key.

- a. Risers Sizes: NPS 3/8.
- b. Risers Material: ASME A112.18.6/CSA B125.6, braided or corrugated stainless-steel flexible hose.

D. Sink Waste Fittings:

- 1. Standard: ASME A112.18.2/CSA B125.2.
- 2. Drain: Grid type with **NPS 1-1/2** offset and straight tailpiece.
- 3. Trap:
 - a. Size: **NPS 1-1/2**.
 - b. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

E. Grout:

- 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- 2. Characteristics: Nonshrink; recommended for interior and exterior applications.
- 3. Design Mix: **5000 psi**, 28-day compressive strength.
- 4. Packaging: Premixed and factory packaged.

2.5 COMMERCIAL URINALS

A. Urinals, Wall Hung:

- 1. Urinals, Wall Hung - Back Outlet, Washout:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Modern Technologies Corporation - AMTC
 - 2) American Standard
 - 3) Briggs Plumbing Products, Inc
 - 4) Gerber Plumbing Fixtures LLC.
 - 5) Kohler Co
 - 6) Mansfield Plumbing Products LLC
 - 7) ProFlo; a Ferguson Enterprises, Inc. brand
 - 8) TOTO USA, INC
 - 9) Zurn; Zurn Elkay
 - b. Fixture:
 - 1) Standards:
 - a) ASME A112.19.2/CSA B45.1.
 - b) ASME A112.19.5/CSA B45.15.

- 2) Material: Vitreous china.
 - 3) Type: Washout with extended shields.
 - 4) Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - 5) Water Consumption: 0.5 gpf.
 - 6) Spud Size and Location: **NPS 3/4**, top.
 - 7) Outlet Size and Location: **NPS 2**, back.
 - 8) Color: White.
- c. Flushometer Valve: Battery operated sensor diaphragm type flush valve.
- d. Waste Fitting:
- 1) Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - 2) Size: **NPS 2**.
- e. Support: Urinal carrier, floor affixed with steel uprights with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
- f. Urinal Mounting Height: Standard & Accessible in accordance with ICC A117.1.

2.6 COMMERCIAL WATER CLOSETS

A. Water Closets, Floor Mounted:

1. Water Closets, Floor Mounted - Bottom Outlet, Top Spud:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Modern Technologies Corporation - AMTC
 - 2) American Standard
 - 3) Briggs Plumbing Products, Inc
 - 4) Gerber Plumbing Fixtures LLC.
 - 5) Kohler Co
 - 6) Mansfield Plumbing Products LLC
 - 7) Sloan Valve Company
 - 8) TOTO USA, INC
 - 9) Zurn; Zurn Elkay
 - b. Source Limitations: Obtain water closets from single source from single manufacturer.
 - c. Standard: ASME A112.19.2/CSA B45.1.
 - d. Bowl:
 - 1) Material: Vitreous china.
 - 2) Type: Siphon jet.
 - 3) Style: Flushometer valve.
 - 4) Height: Standard & Accessible in accordance with ICC A117.1.

- 5) Rim Contour: Elongated.
- 6) Water Consumption: 1.28 gal. per flush.
- 7) Spud Size and Location: **NPS 1-1/2**; top.
- 8) Color: White.

- e. Flushometer Valve: Battery operated sensor diaphragm type flush valve.
- f. Toilet Seat: Open front elongated toilet seat with stainless-steel check hinges.

2.7 FLUSHOMETER VALVES

A. Flushometer Valves, Sensor Operated:

- 1. Flushometer Valves, Sensor Operated - Diaphragm, Battery:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Modern Technologies Corporation - AMTC
 - 2) American Standard
 - 3) Delany Products
 - 4) I-Con Systems, Inc.
 - 5) Sloan Valve Company
 - 6) Zurn; Zurn Elkay
 - b. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
 - c. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
 - d. Minimum Pressure Rating: **125 psig**.
 - e. Features: Include integral check stop and backflow-prevention device.
 - f. Material: Brass body with corrosion-resistant components.
 - g. Style: Exposed.
 - h. Flushometer-Valve Finish: Chrome-plated.
 - i. Consumption: 0.5 gal. urinal & 1.28 gal. toilet per flush.
 - j. Minimum Inlet: NPS 3/4 urinal & NPS 1 toilet.
 - k. Minimum Outlet: NPS 3/4 urinal & NPS 1-1/4 toilet.

2.8 TOILET SEATS

A. Toilet Seats - Commercial:

- 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. American Standard
 - b. Bemis Manufacturing Company

- c. Centoco Manufacturing Corporation
 - d. Church Seats; Bemis Manufacturing Company
 - e. Jones Stephens Corp.
 - f. Kohler Co
 - g. ProFlo; a Ferguson Enterprises, Inc. brand
 - h. TOTO USA, INC
 - i. Zurn; Zurn Elkay
- 2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
 - 3. Standard: IAPMO/ANSI Z124.5.
 - 4. Material: Plastic.
 - 5. Type: Commercial (heavy duty).
 - 6. Shape: Elongated rim, open front.
 - 7. Hinge: Self-sustaining, check.
 - 8. Hinge Material: Noncorroding metal.
 - 9. Seat Cover: Not required.
 - 10. Color: White.
 - 11. Surface Treatment: Not required.

2.9 FIXTURE CARRIERS

A. Fixture Carriers - Lavatory:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Wade; a subsidiary of Zurn Water Solutions
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
- 2. Source Limitations: Obtain lavatory carriers from single source from single manufacturer.
- 3. Standards:
 - a. ASME A112.6.1M.
 - b. ASME A112.6.2.

B. Fixture Carriers - Sink:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company

- c. MIFAB, Inc
 - d. Wade; a subsidiary of Zurn Water Solutions
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
- 2. Source Limitations: Obtain sink carriers from single source from single manufacturer.
 - 3. Standards:
 - a. ASME A112.6.1M.
 - b. ASME A112.6.2.

C. Fixture Carriers - Urinal:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Wade; a subsidiary of Zurn Water Solutions
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
- 2. Source Limitations: Obtain urinal carriers from single source from single manufacturer.
- 3. Standard: ASME A112.6.1M.
- 4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

D. Fixture Carriers - Water Closet:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. MIFAB, Inc
 - c. Wade; a subsidiary of Zurn Water Solutions
 - d. WATTS; A Watts Water Technologies Company
 - e. Zurn; Zurn Elkay
- 2. Source Limitations: Obtain water closet carriers from single source from single manufacturer.
- 3. Standard: ASME A112.6.1M.
- 4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and

feet for installation in wide pipe space.

E. Fixture Carriers - Wash Fountain:

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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Wade; a subsidiary of Zurn Water Solutions
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
2. Source Limitations: Obtain wash fountain carriers from single source from single manufacturer.
3. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 INSTALLATION OF COMMERCIAL PLUMBING FIXTURES

A. Lavatory Installation:

1. Install lavatories level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible, wall-mounted lavatories at mounting height in accordance with ICC A117.1.
4. Install water-supply piping with stop on each supply to each lavatory faucet. Install stops in locations that are accessible for ease of operation.
5. Install trap and waste piping on each drain outlet of each lavatory to be connected to sanitary drainage system.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
8. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

B. Shower Installation:

1. Assemble shower components in accordance with manufacturers' written instructions.

2. Install showers level and plumb in accordance with roughing-in drawings.
3. Install ball or gate valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with ball or gate valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping." Install valves in locations that are accessible for ease of operation.
4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Set shower receptors and shower basins in leveling bed of cement grout.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Showers, except Cast-Polymer Showers: Seal joints between showers, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
8. Cast-Polymer Showers: Adhere panels to drywall using shower manufacturer's recommended adhesive. Seal joints, between panels and between panels and adjacent drywall, using shower manufacturer's recommended caulking specific for each application. Match sealant to fixture color.

C. Sink Installation:

1. Install sinks level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted sinks.
3. Install accessible, wall-mounted sinks at mounting height in accordance with ICC A117.1.
4. Set floor-mounted sinks in leveling bed of cement grout.
5. Install water-supply piping with stop on each supply to each sink faucet.
 - a. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping."
 - b. Install stops/valves in locations that are accessible for ease of operation.
6. Install trap and waste piping on each drain outlet of each sink to be connected to sanitary drainage system.
7. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
8. Seal joints between sinks, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
9. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

D. Urinal Installation:

1. Install urinals level and plumb in accordance with roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste-fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height in accordance with ICC A117.1.
5. Install trap-seal liquid in waterless urinals.
6. Install supports, affixed to building substrate, for wall-hung urinals.
7. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
8. Use carriers without waste fitting for urinals with tubular waste piping.
9. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
10. Measure support height installation from finished floor, not structural floor.
11. Install flushometer-valve, water-supply fitting on each supply to each urinal.
12. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
13. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
14. Install actuators in locations easily reachable for people with disabilities.
15. Install new batteries in battery-powered, electronic-sensor mechanisms.
16. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
17. Seal joints between urinals, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to urinal color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

E. Water Closet Installation:

1. Install water closets level and plumb in accordance with roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.
4. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
5. Use carrier supports with waste-fitting assembly and seal.
6. Install floor-mounted, back-outlet water closets, attached to building floor substrate, onto waste-fitting seals; and attach to support.
7. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals, and affix to building substrate.
8. Measure support height installation from finished floor, not structural floor.
9. Install flushometer-valve, water-supply fitting on each supply to each water closet.
10. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
11. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
12. Install actuators in locations easily reachable for people with disabilities.

13. Install new batteries in battery-powered, electronic-sensor mechanisms.
14. Install toilet seats on water closets.
15. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
16. Seal joints between water closets, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to water-closet color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Wash Fountain Installation:

1. Install wash fountains level and plumb in accordance with roughing-in drawings.
2. Set freestanding wash fountains on floor.
3. Install off-floor carrier supports, affixed to building substrate, for wall-mounted wash fountains.
4. Install accessible, wall-mounted wash fountains at mounting height in accordance with ICC A117.1.
5. Install water-supply piping with shutoff valve on each supply to each wash fountain faucet. Use ball or gate valves if supply stops are not specified with wash fountain. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping." Install stops/valves in locations that are accessible for ease of operation.
6. Install trap and waste piping on each drain outlet of each wash fountain to be connected to sanitary drainage system.
7. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
8. Seal joints between wash fountains, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
9. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.2 INSTALLATION OF PIPING CONNECTIONS

- A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil, waste, and vent piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible plumbing fixtures. Comply with requirements in Section 220719

"Plumbing Piping Insulation."

- E. Where installing piping adjacent to water closets and urinals, allow space for service and maintenance.

3.3 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 INSTALLATION OF CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

END OF SECTION 224200

SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Drinking fountains.
2. Water coolers.
3. Bottle filling stations.
4. Fixture carriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of fixture assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power wiring.

C. Delegated Design Submittals: For vibration isolation and supports, indicated to comply with performance requirements and design criteria, including analysis data.

D. Sustainable Design Submittals:

1. Product Data: For water consumption.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For remote water coolers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is

based and their installation requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drinking fountains, water coolers, bottle filling stations, and remote water coolers to include in maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include servicing and adjustment of electronic-sensor fixtures.

1.5 WARRANTY

- A. Manufacturer Warranty: Manufacturer and Installer agree to repair or replace drinking fountains water coolers bottle filling stations remote water coolers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of cooling system, leaks, defects, etc.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
- B. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Standards:
 - 1. Drinking fountains, water coolers, bottle filling stations, and remote water coolers intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the authority having jurisdiction, and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Delegated Design:
 - 1. Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, supports,, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Product manufacturer's qualified staff to select and size products to achieve specified performance requirements.

2.2 WATER COOLERS

A. Water Coolers - Surface Wall Mounted, Stainless-steel:

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. Elkay
 - b. Halsey Taylor
 - c. Murdock Manufacturing; A Division of Morris Group International
 - d. Oasis International
2. Source Limitations: Obtain surface wall-mounted, stainless-steel, water coolers from single source from single manufacturer.
3. Standards:
 - a. NSF 61.
 - b. NSF 372.
 - c. ASME A112.19.3/CSA B45.4.
 - d. ASHRAE 18.
 - e. UL 399.
 - f. 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.
4. Type: Vandal resistant.
5. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
6. Control: Push bar.
7. Glass filler.
8. Bottle Filler: Sensor activation, with 20-second automatic shutoff timer: Fill rate is 0.5 to 1.5 gpm.
9. Drain: Grid with **NPS 1-1/4** tailpiece.
10. Supply: **NPS 3/8** with shutoff valve.
11. Waste Fitting: ASME A112.18.2/CSA B125.2, **NPS 1-1/4** brass P-trap.
12. Filter: One or more water filters with capacity sized for unit peak flow rate.
 - a. Standards:
 - 1) NSF 42.
 - 2) NSF 53.
13. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
14. Support: Fixture carrier.
15. Water-Cooler Mounting Height: High/low - standard/accessible in accordance with ICC A117.1.
16. Capacities and Characteristics:

- a. Cooled Water: 8 gph.
- b. Ambient-Air Temperature: **90 deg F.**
- c. Inlet-Water Temperature: **80 deg F.**
- d. Cooled-Water Temperature: **50 deg F.**
- e. Cooled-Water Storage: 6 gallon minimum.
- f. Electrical Characteristics:
 - 1) Motor Volts: 120 V ac.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.

2.3 FIXTURE CARRIERS

A. Fixture Carriers:

- 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. Jay R. Smith Mfg Co; a division of Morris Group International
 - b. Josam Company
 - c. MIFAB, Inc
 - d. Wade; a subsidiary of Zurn Water Solutions
 - e. WATTS; A Watts Water Technologies Company
 - f. Zurn; Zurn Elkay
- 2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fixtures level and plumb in accordance with roughing-in drawings. For fixtures indicated for juveniles, install at height required by authorities having jurisdiction.
- B. Set pedestal drinking fountains and bottle filling stations on flat surface in accordance with manufacturer's written installation instructions.
- C. Set freestanding water coolers on floor.
- D. Install recessed drinking fountains and bottle filling stations secured to wood blocking in wall construction.
- E. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- F. Install mounting frames, affixed to building construction, and attach recessed water coolers and bottle filling stations to mounting frames.

- G. Set remote water coolers on floor unless otherwise indicated.
 - 1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - 2. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- H. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- I. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- J. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
- K. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

END OF SECTION 224700

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Strut support systems - rooftop mounted.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Strut support systems - rooftop mounted.
 - 2. Equipment supports.

1.3 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2025 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.

2.2 STRUT SUPPORT SYSTEMS - ROOFTOP MOUNTED

- A. Strut Support System - Rooftop-Mounted Pipe Stand, Compact:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. G-Strut
 - b. MIRO Industries Inc.
 - c. PHP Systems/Design
 - d. RectorSeal HVAC; a CSW Industrials Company
 2. Description: Shop-fabricated assembly made of manufactured corrosion-resistant components to support rooftop-mounted piping.
 3. Configuration: Single-base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 4. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 5. Hardware: Galvanized steel or polycarbonate.
 6. Accessories: Protection pads.
- B. Strut Support System - Rooftop-Mounted Pipe Stand, Single Base, Single Pipe, Low Profile:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. G-Strut
 - b. MIRO Industries Inc.
 - c. PHP Systems/Design
 2. Description: Shop-fabricated assembly made of manufactured corrosion-resistant components to support rooftop-mounted piping.
 3. Configuration: Single-base unit with vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 4. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 5. Horizontal Member: Adjustable-height, galvanized-steel pipe support channels.
 6. Hardware: Galvanized steel.
 7. Accessories: Protection pads.

2.3 MATERIALS

- A. Aluminum: ASTM B221.
- B. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; galvanized.
- C. Stainless-steel: ASTM A240/A240M.
- D. Threaded Rods: Continuously threaded. Galvanized steel for indoor applications and

stainless-steel for outdoor applications. Mating nuts and washers of similar materials as rods.

PART 3 - EXECUTION

3.1 APPLICATION OF HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- B. Install lateral bracing with pipe hangers and supports to prevent swaying.
- C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Coordinate location of concrete inserts before concrete is placed.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- F. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on

rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.
 - a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
 - b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.
 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- G. Pipe Hangers and Supports - Metal: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- H. Pipe Hangers - FRP: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- I. Strut Support Systems - Metal: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.
- J. Strut Support Systems - FRP: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.
- K. Thermal Hanger Shield Inserts: Install in pipe hanger or shield for insulated piping.
- L. Fastener Systems:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick after concrete is placed and cured. Use installers that are trained and certified by power tool manufacturer.
 2. Install mechanical-expansion anchors after concrete is placed and completely cured.
 3. Install fasteners in accordance with manufacturer's written instructions.
 4. Install lag screw wood fasteners in accordance with manufacturer's written instructions.

M. Strut Support Systems - Rooftop Mounted:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

N. Hangers and Supports, General: Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

O. Equipment Supports:

1. Fabricate from welded-structural-steel shapes.
2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
3. Grouting: Place grout under supports for floor-mounted equipment and make bearing surface smooth.
4. Provide lateral bracing, to prevent swaying.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" or Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3. Comply with requirements in Section 09911 "Exterior Painting (MPI Standards)", Section 099124 "Interior Painting (MPI Standards)" or Section 099601 "High-Performance Coatings (MPI Standards)" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
4. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon Steel or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon Steel or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve-Numbering Scheme: For each piping system.
- E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. Craftmark Pipe Markers
 - d. Pipemarket.com; Brimar Industries, Inc.
 - e. Seton Identification Products; a Brady Corporation company
 - 2. Material and Thickness: Brass, 0.032-inch or stainless-steel, 0.025-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
 - 3. Letter and Background Color: As indicated for specific application under Part 3.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24

inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP
 - c. Craftmark Pipe Markers
 - d. Pipemarket.com; Brimar Industries, Inc.
 - e. Seton Identification Products; a Brady Corporation company
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- C. Label Content:** Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

PART 3 - EXECUTION

3.1 PREPARATION

- A.** Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

- A.** Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Equipment Label Colors:
 - 1. White letters on an ANSI Z535.1 safety-blue background.
- C. Locate equipment labels where accessible and visible.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes:
 - 1. TAB of Air Systems:
 - a. Constant-volume air systems.
 - 2. TAB of equipment.
 - 3. Sound tests.
 - 4. HVAC-controls verification.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. FFT: Fast Fourier transform.
- C. INCE: Institute of Noise Control Engineering
- D. NC: Noise criteria.
- E. NEBB: National Environmental Balancing Bureau.
- F. RC: Room criteria.
- G. TAB: Testing, adjusting, and balancing.
- H. TABB: Testing, Adjusting, and Balancing Bureau.
- I. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.3 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.

- b. The TAB plan.
- c. Requirements for coordination and cooperation of trades and subcontractors.
- d. Proposed procedures for documentation and communication flow.

1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in "Examination" Article, if issues are discovered that may preclude the proper testing and balancing of the systems.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article, to be used and filled out by systems installers verifying that systems are ready for TAB.
- E. Certified TAB Reports: Within 14 days of completion of testing and balancing work.
 - 1. Submit one electronic copy of the final TAB report to the design professional of record's firm. Provide five additional copies to Contractor.
- F. Sample Report Forms: For each specified report.
- G. Instrument Calibration Reports: Include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration and calibration interval.

1.6 QUALITY ASSURANCE

- A. TAB Specialist Firm's Qualifications, Certified by AABC:
 - 1. TAB Field Supervisor: Employee of the TAB specialist firm and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist firm and certified by AABC.

- B. TAB Specialist Firm's Qualifications: Certified by NEBB or TABB.
 - 1. TAB Certified Professional: Employee of the TAB specialist firm and certified by NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist firm and certified by NEBB or TABB.
 - 3. TAB specialist firm is to be independent, third-party, and unaffiliated with Contractor.
- C. Sound and Vibration Specialists: NEBB-certified Sound and Vibration Technician TABB-certified Sound and Vibration Technician or licensed professional engineer who specializes in acoustical engineering.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- E. ASHRAE 111 Compliance: For testing and balancing of HVAC systems.
- F. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.3.3 - "System Balancing."
- G. Code and Authorities Having Jurisdiction Compliance: Furnish TAB services that comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in system designs that may preclude proper TAB of systems and equipment. Submit Contract Documents Examination Report summary of findings.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for TAB.
- C. Examine the approved submittals for HVAC systems and equipment.

- D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- E. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean and permanent filters are installed, and equipment with functioning controls is ready for operation.
- F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- G. Observe demonstration of operating safety interlocks and controls on HVAC equipment.
- H. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed and are in normal operating positions.
 - j. Note location of balancing devices that are inaccessible.
 - k. UFAD-Specific Requirements:
 - 1) Verify that raised access panels are installed.
 - 2) Verify that air plenums are free of debris.
 - 3) Verify that air plenum dividers are installed.
 - 4) Follow procedures to measure Category 1 and 2 leakage in AABC's "National Standards to Total System Balance."

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. Installing Contractor to Perform the Following:
 - a. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - b. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - c. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
 - d. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation."
- B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP units).
- D. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Motors.
 - 2. Fans and ventilators.
 - 3. Unit heaters.
 - 4. Condensing units.
 - 5. Air-handling units.
 - 6. Rooftop air-conditioning units.
 - 7. Dedicated outdoor-air units.
 - 8. Packaged air conditioners.
 - 9. Split-system air conditioners.
 - 10. Heat pumps.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems or color-coded HVAC drawings for the purpose of identifying HVAC components, including each air terminal unit and each air diffuser, register, and grille.
- C. For variable-air-volume systems, develop a plan to simulate diversity and include in TAB plan.
- D. Determine suitable locations in main and branch ducts for accurate duct-airflow measurements.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
- F. Verify that motor controllers are equipped with properly sized thermal protection.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet.
 - b. Measure static pressure directly at the fan inlet.
 - c. Measure static pressure differential across each component that makes up the air-handling system.
 - d. Apply artificial loading of filters to simulate a dirty filter pressure drop condition at the time static pressures are measured.
 - 3. Obtain approval from Owner's Representative for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode

to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all volume dampers have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets' and outlets' airflow. Apply correction factors as applicable for each size and style of air device.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
 - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design range. Readjust to within design tolerance if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
 - 4. Traverse the supply airflow in full airside economizer mode. Observe the mixed air plenum pressure as compared to normal operation: return air dampers open and minimum outside air varying to 100 percent outside air dampers fully open and return air dampers fully closed. Mixed air pressure is to remain constant plus/minus 20 percent or, otherwise, damper/fan adjustments will be required.
 - 5. Mark all final settings.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

- A. Motors: 1/2 hp and larger; test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation. Verify and report Hz at maximum and minimum flows.

3.8 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

- A. Verify proper rotation of fan(s).
- B. Measure and record entering- and leaving-air temperatures.
- C. Measure and record operating data of compressor(s), fan(s), and motors.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each hydronic coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
 - 8. Use coil pressure drop to determine flow if no flow meter measurement exists.
 - 9. Use temperatures and flows to calculate actual capacity on each coil and heat-transfer coils.
- B. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Air pressure drop.
 - 5. Voltage and amperage input of each phase at full load.
 - 6. Record full load kW.
 - 7. Record fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Airflow.
 - 3. Air pressure drop.
 - 4. Record inlet steam pressure from installed gauge.
- D. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.

3.10 HVAC-CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:

1. Work to ensure the system is operating within the design limitations and gain a mutual understanding of intended controls performance.
 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as indicated.
 5. Verify the operation of lockout or interlock systems.
 6. Verify the operation of valve and damper actuators.
 7. Verify that controlled devices are properly installed and connected to correct controller.
 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 TOLERANCES

- A. Set HVAC system's airflow rates and water-flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus, or minus 10 percent. If design value is less than 100 cfm, flow rate is within 10 cfm.
 2. Air Outlets and Inlets: Plus, or minus 10 percent. If design value is less than 100 cfm, flow rate is within 10 cfm.
- B. Maintaining pressure relationships as designed is to have priority over the tolerances specified above. If the above tolerances change the relative positive or negative airflow from/into the space, tolerances are to be adjusted to keep the relative positive cfm or negative cfm from/into the space a constant cfm differential.

3.12 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL TESTING AND BALANCING REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist firm and technician.
 - 3. Project name.
 - 4. Project location.
 - 5. Project Owner's Representative's name, firm, and address.
 - 6. Project Engineer's name, firm, and address.
 - 7. Project Contractor's name, firm, and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fan performance forms, including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Heating coil, dry-bulb conditions.
 - e. Fan drive settings, including settings and percentage of maximum pitch

diameter.

- f. Settings for pressure controller(s).
- g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

- 1. Quantities of outdoor, supply, return, and exhaust airflows.
- 2. Duct, outlet, and inlet sizes.
- 3. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.

2. Motor Data:

- a. Motor make and frame type and size.
- b. Horsepower and speed.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan speed.
- d. Inlet and discharge static pressure in inches wg.
- e. For each filter bank, filter static-pressure differential in inches wg.
- f. Cooling-coil static-pressure differential in inches wg.
- g. Heating-coil static-pressure differential in inches wg.

- h. List for each internal component with pressure-drop, static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft.
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Coil identification.
- d. Capacity in Btu/h.
- e. Number of stages.
- f. Connected volts, phase, and hertz.
- g. Rated amperage.
- h. Airflow rate in cfm.
- i. Face area in sq. ft.
- j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

- a. Heat output in Btu/h.

- b. Airflow rate in cfm.
- c. Air velocity in fpm.
- d. Entering-air temperature in deg F.
- e. Leaving-air temperature in deg F.
- f. Voltage at each connection.
- g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

- a. Motor make and frame type and size.
- b. Horsepower and speed.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan speed.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System fan and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft.

- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

- a. System and air-handling-unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Entering-water temperature in deg F.
- c. Leaving-water temperature in deg F.
- d. Water pressure drop in feet of head or psig.
- e. Entering-air temperature in deg F.
- f. Leaving-air temperature in deg F.

L. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration and interval.

3.14 VERIFICATION OF TAB REPORT

- A. The TAB specialist firm's test and balance technician is to conduct the final verification in the presence of Owner's Representative.
- B. Owner's Representative are to randomly select measurements, documented in the final report, to be rechecked. Rechecking is to be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements are to be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB are to be considered incomplete and are to be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
 1. TAB specialists are to recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes are to be tracked to show changes made to previous report.
 2. If the second final inspection also fails, Owner may pursue other Contract options to complete TAB work.
- F. Prepare test and inspection reports.

3.15 REVERIFICATION

- A. TAB specialist firm technicians are to recheck all measurements and make adjustments as required to complete the balancing. Revise the final report and balancing device settings to include all changes; resubmit final report and request a second verification.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber duct insulation.
2. Insulation adhesives.
3. Insulation mastics and coatings.
4. Insulation corner angles.

B. Related Requirements:

1. Section 233113 "Metal Ducts" for duct insulation liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties, and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

B. Field Quality Control Reports: For specified tests and inspections.

C. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes, and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 DUCT INSULATION MATERIALS, GENERAL

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.
- B. Products are not to contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless-steel are to have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless-steel are to be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials are not to use CFC or HCFC blowing agents in the manufacturing process.

2.3 GLASS-FIBER DUCT INSULATION

- A. Duct Insulation Wrap - Glass-Fiber Blanket:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
 - a. CertainTeed; Saint-Gobain North America
 - b. Johns Manville; a Berkshire Hathaway company
 - c. Knauf Insulation
 - d. Owens Corning
 - 2. Description: Glass-fiber blanket duct insulation wrap consisting of glass fibers bonded with a thermosetting resin.
 - 3. Suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411.
 - 4. Standards: ASTM C553, Type II, and ASTM C1290.
 - 5. Without Insulation Facing: Type I.
 - 6. Factory-Applied Insulation Facing:
 - a. FSK: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type III.
 - b. FSP: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type III.
 - c. Vinyl: White vinyl with a permeance of 1.3 perms when tested in accordance with ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.4 INSULATION ADHESIVES

- A. Materials are to be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

B. Insulation Adhesive for Glass Fiber and Mineral Wool:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products
 - b. Foster Brand; H. B. Fuller Construction Products
 - c. Mon-Eco Industries, Inc.
2. Standard: MIL-A-3316C, Class 2, Grade A.
3. Adhesive: As recommended by mineral-fiber manufacturer and with a VOC content of 80 g/L or less.

2.5 INSULATION MASTICS AND COATINGS

A. Duct Insulation Vapor-Retarder Mastic - Water Based, Indoor Use:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Aeroflex USA
 - b. Childers Brand; H. B. Fuller Construction Products
 - c. Foster Brand; H. B. Fuller Construction Products
 - d. Knauf Insulation
 - e. Vimasco Corporation
2. Suitable for indoor use on below-ambient services.
3. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
4. Service Temperature Range: Minus 20 to plus 180 deg F.
5. Standard: MIL-PRF-19565C, Type II, for permeance requirements.
6. Color: White.

2.6 FIELD-APPLIED INSULATION JACKETS

- A. Field-applied jackets are to comply with ASTM C921, Type I unless otherwise indicated.
- B. Insulation Jacket, Field Applied - FSK: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.7 INSULATION SECUREMENTS

- A. Insulation Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless-steel or Monel.

2.8 INSULATION CORNER ANGLES

A. Insulation Corner Angle - PVC:

1. Thickness: 30 mils.
2. Dimensions: Minimum 1 by 1 inch.
3. Material: PVC in accordance with ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Insulation Corner Angle - Aluminum:

1. Thickness: 0.040 inch.
2. Dimensions: Minimum 1 by 1 inch.
3. Material: Aluminum in accordance with ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Insulation Corner Angle - Stainless-steel:

1. Thickness: 0.024 inch.
2. Dimensions: Minimum 1 by 1 inch.
3. Material: Stainless-steel in accordance with ASTM A240/A240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### **A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.**
1. Verify that duct systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- #### **B. Proceed with installation only after unsatisfactory conditions have been corrected.**

3.2 PREPARATION

- #### **A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.**

3.3 GENERAL INSULATION INSTALLATION REQUIREMENTS

- #### **A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.**
- #### **B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.**
- #### **C. Install accessories compatible with insulation materials and suitable for the service.**

Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - 4. For below ambient services, apply vapor-barrier mastic over staples.
 - 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 INSTALLATION OF INSULATION AT PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations That Are Not Fire Rated: Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies with a UL Listed Firestop System.

3.5 INSTALLATION OF GLASS-FIBER DUCT INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- B. Comply with manufacturer's written installation instructions.
 - 1. Apply adhesives in accordance with manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Weld-Pin Installation: Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-ft. intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation

surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

- C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives in accordance with manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Weld-Pin Installation: Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-ft. intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Owner's Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation.
 - 2. Extent of inspection is limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.
- D. Prepare test and inspection reports.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 - 7. Indoor, concealed oven and warewash exhaust.
 - 8. Indoor, exposed oven and warewash exhaust.
 - 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 11. Outdoor, concealed supply and return.
 - 12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Round and Flat-Oval, Supply-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- B. Concealed, Round and Flat-Oval, Return-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- C. Concealed, Round and Flat-Oval, Outdoor-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- D. Concealed, Round and Flat-Oval, Exhaust-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- E. Concealed, Rectangular, Supply-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- F. Concealed, Rectangular, Return-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- G. Concealed, Rectangular, Outdoor-Air Duct Insulation: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.

- H. Concealed, Rectangular, Exhaust-Air Duct Insulation between Isolation Damper and Penetration of Building Exterior: To be one of the following:
1. Duct Insulation Wrap - Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:
 - 1. Air, steam, and hydronic distribution systems.
 - 2. HVAC controls.
 - 3. TAB verification.
- B. Related Requirements:
 - 1. For construction checklists, comply with requirements in various Division 23 Sections specifying HVAC systems, system components, equipment, and products.

1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. IgCC: International Green Construction Code.
- C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they mean "as-built" systems, assemblies, subsystems, equipment, and components.
- D. TAB: Testing, adjusting, and balancing.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For BAS and HVAC testing technician.
- B. Construction Checklists:
 - 1. Cx plan, including material, installation, and performance construction checklists for systems, assemblies, subsystems, equipment, and components relating to BAS and HVAC to be part of the Cx process.
- C. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Div. 23 Subcontractor, provide the following:
 - 1. Equipment/instrument identification number.
 - 2. Planned Cx application or use.

3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:
 - a. Instrument or tool identification number.
 - b. Equipment schedule designation of equipment for which the instrument or tool is required.
 - c. Manufacturer, make, model, and serial number.
 - d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.4 QUALITY ASSURANCE

- A. BAS Testing Technician Qualifications: Technicians performing BAS Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations are to have the following minimum qualifications:
 1. Journey level or equivalent skill level with knowledge of BAS, HVAC, electrical concepts, and building operations.
 2. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.
 3. International Society of Automation (ISA)-Certified Control Systems Technician (CCST) Level I.
- B. HVAC Testing Technician Qualifications: Technicians to perform HVAC Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
 1. Journey level or equivalent skill level; vocational school four-year-program graduate or an Associate's degree in mechanical systems, air conditioning, or similar field. Degree may be offset by three years' experience in servicing mechanical systems in the HVAC industry. Generally, required knowledge includes HVAC systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of HVAC equipment, assemblies, and systems.
 2. Minimum three years' experience that is to include installing, servicing, and operating systems manufactured by approved manufacturer.
- C. Testing Equipment and Instrumentation Quality and Calibration:
 1. Capable of testing and measuring performance within the specified acceptance criteria.
 2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
 3. Be maintained in good repair and operating condition throughout duration of use on Project.
 4. Be recalibrated/repared if dropped or damaged in any way since last calibrated.

D. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:
 - a. Be calibrated by manufacturer with current calibration tags permanently affixed.
 - b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
2. HVAC proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Cx PROCESS

- A. Perform Cx process in accordance with the following:
1. ASHRAE 202.
 2. Commissioning standards acceptable to the authority having jurisdiction.

3.2 CONSTRUCTION CHECKLISTS

- A. Preliminary detailed construction checklists are to be prepared for each BAS and HVAC system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in ASHRAE 202. Contractor performs the following:
1. Review BAS and HVAC preliminary construction checklists and provide written comments on checklist items where appropriate.
 2. Return preliminary Construction Checklist with review comments within 10 days of receipt.
 3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
 4. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place as project events are completed and provide pertinent details and other information.
- B. Prepare preliminary detailed construction checklists for each BAS and HVAC system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in ASHRAE 202.
1. Submit preliminary construction checklists to CxA and Designer for review.
 2. When review comments have been resolved, the CxA will provide final

- construction checklists marked "Approved for Use, (date)."
3. Use only construction checklists, marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place as project events are completed and provide pertinent details and other information.
- C. Additional systems required to be commissioned:
1. Air-handling systems, including the following:
 - a. Supply, return, and exhaust air fans, motors, and drives.
 - b. Automatic and gravity dampers.
 - c. Heating and cooling devices.
 - d. Air filters.
 - e. Interlock between air-handling system and fire/smoke alarm system.
 2. Controls and instrumentation, including the following:
 - a. Controllers and sensors.
 - b. Automatic control valves, dampers, and actuators.
 - c. Control interface with fans, pumps, dampers, and other equipment and systems.
 3. TAB Verification:
 - a. Airflow.
 4. Documentation:
 - a. Mechanical systems manuals.
 - b. Documentation of required commissioning.
 5. Mechanical insulation, including the following:
 - a. Duct and plenum insulation.
 - b. HVAC piping insulation.

3.3 Cx TESTING PREPARATION

- A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.
- B. Certify that HVAC instrumentation and control systems have been completed and calibrated, point-to-point checkout has been successfully completed, and systems are operating in accordance with their design sequence of operation, Contract Documents, and approved submittals. Certify that all sensors are operating within specified accuracy and all systems are set to and maintaining set points as required by the design documents.
- C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

- D. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.4 Cx TEST CONDITIONS

- A. Perform tests using design conditions, whenever possible.
 - 1. Simulated conditions may, with approval of Owner's Representative, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
 - 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
 - 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- B. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to Owner's Representative. After deficiencies are resolved, reschedule tests.
- C. If seasonal testing is specified, complete appropriate initial performance tests and documentation, and schedule seasonal tests.

3.5 Cx TESTS COMMON TO HVAC SYSTEMS

- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
- B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response in accordance with acceptance criteria.
- C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
- D. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance test requirements specified in Division 23 Sections specifying HVAC systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
 - 1. Cx Construction Checklist verification tests.
 - 2. Cx Construction Checklist verification test demonstrations.

3.6 TAB VERIFICATION

- A. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
- B. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
- C. Scope: HVAC air systems and hydronic piping systems.
- D. Purpose: Differential flow relationships intended to maintain air and water pressurization differentials between the various areas of Project.
- E. Conditions of the Test:
 - 1. Cx Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
 - 2. Systems operating in full heating mode.
 - 3. Systems operating in full cooling mode.
 - 4. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.
- F. Acceptance Criteria:
 - 1. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 230593 "Testing, Adjusting, and Balancing for HVAC."
 - 2. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than the tolerances allowed.
 - 3. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

END OF SECTION 230800

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.0 SECTION INCLUDES

- 1.1 BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION
- 1.2 APPROVED CONTROL SYSTEM MANUFACTURERS
- 1.3 QUALITY ASSURANCE
- 1.4 CODES AND STANDARDS
- 1.5 SYSTEM PERFORMANCE
- 1.6 SUBMITTAL REQUIREMENTS
- 1.7 WARRANTY REQUIREMENTS
- 1.8 SYSTEM MAINTENANCE AND REMOTE ANALYSIS
- 1.9 OWNERSHIP OF PROPRIETARY MATERIAL
- 1.10 DEFINITIONS

1.1 BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION

- A. Provide a new Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project.
 - 1. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.
 - 2. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.
 - 3. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.

4. Approved vendors, products and web services shall comply with SOC2 Type II as defined by the AICPA. SOC2 Type II compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).
 - a. SOC2 Type II compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.
 - b. To achieve SOC2 Type II compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.
5. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

1.2 APPROVED CONTROL SYSTEM MANUFACTURERS

A. Approved BAS Manufacturers

1. Trane Tracer®

1.3 QUALITY ASSURANCE

A. BAS Manufacturer Qualifications

1. The BAS manufacturer shall have an established business office within 50.00 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.
2. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.
3. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.
4. Independent representatives of BAS manufacturers are not acceptable. BAS vendor must be corporate owned entity of BAS manufacturer.

1.4 CODES AND STANDARDS

- A. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 2. National Electrical Code -- NFPA 70.
 3. Federal Communications Commission -- Part J.
 4. ASHRAE/ANSI 135-2012 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.
 5. ASHRAE/ANSI 135-2012 (BACnet) - (Unit Level Devices) - Unit Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

1.5 SYSTEM PERFORMANCE

- A. Performance Standards. The BAS system shall conform to the following:
1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.
 2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.
 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.
 4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.
 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.
 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
 8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

1.6 SUBMITTAL REQUIREMENTS

- A. BAS manufacturer shall provide shop drawings and manufacturers' standard

specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.

1. Provide three (3) printed copies of submittal package for review and approval.
- B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review should not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.
- C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.
- D. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats once they have been approved and as-built drawings have been completed.
- E. Submit the following within 90 days of contract award:
 1. A complete bill of materials of equipment to be used indicating quantities, manufacturers and model numbers.
 2. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.
 3. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.
 4. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:
 - a. Building Controllers
 - b. Custom Application Controllers
 - c. Application Specific Controllers
 - d. Operator Workstations
 - e. Portable Operator Terminals
 - f. Auxiliary Control Devices
 5. Provide proposed Building Automation System Architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements.
 6. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.
 7. Provide a sequence of operation for each controlled mechanical system and terminal end devices.
 8. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

- F. Project Record Documents: Upon completion of installation, submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .dwg and .pdf drawing files shall be provided.
 2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
 3. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:
 - a. Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.
 - b. Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.
 - c. Documentation, installation, and maintenance information for all third party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.
 - d. Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
 - e. Licenses, Guarantee, and Warranty documents for all equipment and systems.
- G. Training Manuals: The BAS manufacturer shall provide a course outline and copies of training manuals at least two weeks prior to the start of any corporate training class to be attended by the Owner.

1.7 WARRANTY REQUIREMENTS

- A. Warrant all work as follows:
1. BAS system labor and materials shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. BAS failures during the warranty period shall be adjusted, repaired, or replaced at no charge to the Owner. The BAS manufacturer shall respond to the Owner's request for warranty service within 24 hours of the initiated call and will occur during normal business hours (8AM-5PM).
 2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the BAS is operational, and has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of the warranty period.
 3. To ensure that the owner will have the most current operating system provided by the manufacturer, the BAS manufacturer shall include licensing and labor costs to facilitate software/firmware updates throughout the warranty period at no charge to the owner. These updates shall include upgrades for functional

enhancements associated with the following: operator workstation software, project specific software, graphics, database, firmware updates, and all security related service packs. Written authorization by the Owner must be granted prior to the installation of these updates.

4. The BAS manufacturer shall provide a web-accessible Users Network for the proposed System and give the Owner free access to question/answer forum, user tips, upgrades, and training schedules for a one year period of time correlating with the warranty period.

1.8 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

- A. The BAS Manufacture shall provide Building Automation System remote technical support and system analysis for a period of 1 year (beginning the date of substantial completion).
- B. The BAS manufacturer shall setup a secure remote connection for data collection, analytics and remote technical support for the HVAC systems included in this contract.
 1. Provide technician support during the warranty period to diagnose issues remotely through the secure remote connection.
 2. The building owner is responsible for providing adequate internet access.
- C. Connectivity / Remote Access / Network Security
 1. Provide and maintain secure remote access to the facilities Building Automation System (BAS) or other building systems. Users accessing service through this connection shall not have access to the building owners' network. Secure remote access to the BAS shall not require ANY inbound ports on a firewall to be "exposed" or "forwarded."
 2. Secure remote access to the BAS shall be available anywhere, anytime, using a compatible client device (PC/tablet/phone)
 3. The Owner will provide up to Three (3) IP drops and IP addresses on the owners network to gain access to the internet. The BAS manufacture shall coordinate with the Owners IT team, verify the proposed system shall meet all network security requirements and any other network configuration information necessary to each control contractor for the purpose of configuring each Area Controller on the network. It shall be the responsibility of the BAS manufacture to coordinate with the owner for network connectivity.
- D. The BAS Manufacture shall provide a professional analysis for the facility HVAC systems.
 1. The analysis shall consist of an evaluation of HVAC systems including charts and graphs which indicate both current building performance and opportunities for building and HVAC system performance improvement.
- E. The following shall be provided after substantial completion of the project:
 1. Orientation meeting with the building owner's representative to identify the HVAC systems that will be evaluated.

2. System setup for data collection and analytics. BAS Manufacture to setup a secure remote data collection and analytics for identified systems.
 3. Assessment analysis shall be performed by trained personnel with relevant professional credentials in HVAC systems, energy management and building optimization methodologies.
 4. Consultation meeting with owner to review performance reports and improvement opportunities.
- F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

- A. Project specific software and documentation shall become the owner's property upon project completion. This includes the following:
1. Operator Graphic files
 2. As-built hardware design drawings
 3. Operating & Maintenance Manuals
 4. BAS System software database

1.10 DEFINITIONS

- A. DDC: Direct digital control
- B. I/O: Input/output.
- C. MS/TP: Manager Subordinate / Token Passing.
- D. POT: Portable Operator's Terminal.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.
- G. BAS/ATC: Building Automation System/Automatic Temperature Controls.

PART 2 PRODUCTS

2.0 SECTION INCLUDES

- 2.1 MATERIALS:
- 2.2 SYSTEM COMMUNICATION:
- 2.3 OPERATOR INTERFACE:
- 2.4 BUILDING CONTROLLER SOFTWARE:

- 2.5 BUILDING / SYSTEM CONTROLLERS:
- 2.6 ADVANCED APPLICATION CONTROLLERS:
- 2.7 APPLICATION SPECIFIC CONTROLLERS:
- 2.8 APPLICATION CONTROLLER for Packaged Rooftop Units
- 2.9 INPUT/OUTPUT INTERFACE:
- 2.10 POWER SUPPLIES:
- 2.11 AUXILLARY CONTROL DEVICES:
- 2.12 WIRING AND RACEWAYS:

2.1 MATERIALS:

- A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Do not use this installation as a product test site unless explicitly approved in writing by the owner or the owner's representative. Spare parts shall be available for at least five years after completion of this contract.

2.2 SYSTEM COMMUNICATION:

- A. System Communications
 - 1. Each workstation, building controller, and equipment/plant controller communication interface shall utilize the BACnet™ protocol with an Ethernet (IEEE 802.3) or RS485 (EIA-485) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet SC, BACnet over MS/TP).
 - 2. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.
 - 3. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.
 - 4. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.
 - 5. All Operator Workstations (B-OWS, B-AWS) and Building Controllers (B-BC) shall support BACnet Secure Connect (BACnet SC), a secure and encrypted datalink layer specifically designed for those networks.
- B. Field Bus Communications
 - 1. BACnet™
 - a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application

- Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.
- b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.
- c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.
- d. Communication between System Controller and equipment/plant controllers shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.

2.3 OPERATOR INTERFACE:

A. Provide Building Operator Web Interface

1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
2. The building operator web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
3. User Roles
 - a. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
 - b. User logon/logoff attempts shall be recorded.
 - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
4. On-Help and Training
 - a. Provide a context sensitive, online help system to assist the operator in operation and configuration of the system.
 - b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.
5. Equipment and Application Pages
 - a. The building operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
 - 1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
 - a) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.

- b) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
 - 2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
 - 3) Historical Data (As defined in Trend Logs section of CONTROLLER SOFTWARE) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
- 6. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system.
 - a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
 - b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
 - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
- 7. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
- 8. Manual Control and Override
 - a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
 - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
 - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
 - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
- 9. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.
- 10. Alarm/Event Notification
 - a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
 - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.

- 2) The operator shall be able to acknowledge and add comments to alarms
 - 3) Alarm/event messages shall use full language, easily recognized descriptors.
 - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.
11. Reports and Logs.
- a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
 - b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
 - c. The following standard reports shall be available without requiring a user to manually configure the report:
 - 1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
 - 2) All Points in Override Report: Provide an on demand report showing all overrides in effect.
 - 3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
 - 4) Points report: Provide a report that lists the current value of all points
 - d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

B. Provide Mobile App Interface

1. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android™ operating systems.
2. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.
3. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).
4. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
5. The operator interface shall support system access on a mobile device via a mobile app to:
 - a. Alarm log
 - b. System Status
 - c. Equipment status
 - d. Space Status
 - e. Standard Equipment graphics

- f. Override set points
- g. Override occupancy
- h. Acknowledge Alarms
- i. Add Comment(s) to Alarms

2.4 BUILDING CONTROLLER SOFTWARE:

- A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.
- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.

1. Trend Logs

- a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.

1) Fan Coil / Cabinet Unit Heater / Unit Ventilator / WSHP Unit

- a) Discharge Air Temperature
- b) Space Temperature Active
- c) Space Temperature Setpoint Active
- d) Air Flow Setpoint Active
- e) Discharge Air Flow

2) Air Handling Unit/Rooftop (VAV)

- a) Discharge Air Temperature
- b) Discharge Air Temperature Setpoint Active
- c) Space Temperature Active
- d) Cooling Capacity Status
- e) Discharge Air Flow

3) Air Handling Unit/Rooftop (CV)

- a) Discharge Air Temperature
- b) Space Temperature Active
- c) Space Temperature Setpoint Active
- d) Cooling Capacity Status
- e) Heating Capacity Primary Status
- f) Outdoor Air Damper Position

- 4) VAV Terminal Unit
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Air Flow Setpoint Active
 - e) Discharge Air Flow
- 5) Variable Air System (VAS)
 - a) VAS Operating Mode
 - b) Duct Static Optimization Duct Static Setpoint
 - c) Duct Pressure Optimization Maximum
 - d) Space Temperature Average
 - e) Ventilation Optimization Air Setpoint

2.5 BUILDING / SYSTEM CONTROLLERS:

- A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
 - 1. The controller shall provide a USB communications port for connection to a PC.
 - 2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - 3. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
 - 4. Data shall be shared between networked System Controllers.
 - 5. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
- B. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

2.6 ADVANCED APPLICATION CONTROLLERS:

- A. Advance Application Controllers shall be used to control all equipment or applications of medium and high complexity, including but not limited to Air Handlers, Boiler Plants and Chiller Plants.
- B. The Advanced Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- C. When the Advanced Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 4. In case of communications failure, stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
- D. For Stand-Alone Operation of Advanced Application Controllers:
1. Shall operate a schedule in a standalone application using a Real Time Clock with a 7 day power backup.
 - a. The Controller shall have a built in schedule (assessable with or without a display)
 - b. Support will be for at least 3 schedules with up to 10 events for each day of the week.
 - c. Each of the 3 schedules can be Analog, Binary or Multi-State
 - d. The controller shall support a minimum of 25 exceptions each with up to 10 events.
- E. For ease of troubleshooting, the Controller shall support data trend logging.
1. With a minimum of 20,000 trending points total on a controller
 2. Trends shall be capable of being collected at a minimum sample rate of once every second
 3. Shall be capable of trending all BACnet points used by controller
 4. Trends shall be capable of being scheduled or triggered.
- F. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
- G. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
1. Operating conditions:
 - a. Temperature: -40°F to 158°F (-40°C to 70°C)
 - b. Relative Humidity: 5% to 100% RH (non-condensing)
 2. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 3. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].
- H. Input/Output: The Controller shall have on board or through expansion module all I/O

capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment. In addition, other controls must meet the following requirements:

1. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.
 2. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.
 3. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.
 4. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.
 5. The controller shall support pulse accumulator for connecting devices like energy meters.
 6. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.
 7. For future needs, any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.
 8. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.
 9. The Controller shall provide a dedicated static pressure input.
- I. Input/Output Expandability – The Controller shall provide the following functionality in order to meet current and future application needs:
1. For the application flexibility, the Controller shall be capable of expanding to a total of at least 100 hardware I/O terminations.
 2. Expansion I/O can be mounted up to 650 ft. (200m) from control.
 3. For optimized system operation, expansion I/O must communicate via an internal controller communication bus (point expansion via the BACnet MS/TP network is not allowed).
- J. Serviceability – The Controller shall provide the following in order to improve serviceability of the Controller.
1. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.
 2. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.
 3. Software service tool connection through the following methods: direct cable connection to the Controller, connection through another controller on BACnet link
 4. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.

5. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.
 6. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.
 7. To aid in service replacement, the Controller shall easily attach to standard DIN rail mounting.
 8. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).
 9. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.
 10. Controller data shall be maintained through a power failure.
- K. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- L. Controller must meet the following Agency Compliance:
1. UL916 PAZX, Open Energy Management Equipment
 2. UL94-5V, Flammability
 3. FCC Part 15, Subpart B, Class B Limit
 4. BACnet Testing Laboratory (BTL) listed as BACnet Advanced Application Controller (B-AAC)

2.7 APPLICATION SPECIFIC CONTROLLERS:

- A. General Description
1. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
 2. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.
- B. The Application Specific Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- C. When the Application Specific Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).

2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
- D. Stand-Alone Operation: Each piece of equipment specified in section "A" shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.
- E. Software
1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 2. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
- F. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
 2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
 3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].
- G. Input/Output:
1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.
 3. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 4. For flexibility in selection and replacement devices, the controller's shall have binary output which are able to drive at least 12VA each.
 5. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
 6. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.
 7. For future expansion and flexibility, the controller shall have either on board or

through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.

- H. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 2. All binary output shall have LED's indicating the output state.
 3. All wiring connectors shall removable without the use of a tool.
 4. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link
 5. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
 6. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 7. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
 - a. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
 8. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
 - a. With a minimum of 20,000 trending points total on controller
 - b. Trends shall be capable of being collected at a minimum sample rate of once every second.
 - c. Shall be capable of trending all BACnet points used by controller
 - d. Trends shall be capable of being scheduled or triggered
- I. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- J. Application controller shall meet the following Agency Compliance:
1. UL916 PAZX, Open Energy Management Equipment
 2. UL94-5V, Flammability
 3. FCC Part 15, Subpart B, Class B Limit
 4. BACnet Testing Laboratory (BTL) listed as BACnet Application Specific Controller (B-ASC)

2.8 APPLICATION CONTROLLER for Packaged Rooftop Units

- A. The Rooftop Unit (RTU) Application Controller shall be a microprocessor-based DDC controller which, through hardware or firmware design, controls specified equipment. The controller is not user programmable, but is customized for operation within the confines of the equipment it is designed to serve.
- B. The Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- C. When the Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - 1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - 2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 - 3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - 4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
- D. Software
 - 1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or customized with use of service tool native to the controller.
- E. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - 1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
 - 2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
 - 3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - 4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].
- F. Controller Input/Output: The controller shall have on board capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment.
 - 1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following output types; 0-10VDC, 0-5VDC, 4-20mA, Binary.
 - 2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, Pulse counts, and 200 to 20Kohm.

- G. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
 - 1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 - 2. All binary output shall have LED's indicating the output state.
 - 3. All wiring connectors shall removable without the use of a tool.
 - 4. Software service tool connection through the following methods: direct cable connection to the controller, connection through another controller on BACnet link.
- H. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- I. Controller shall meet the following Agency Compliance:
 - 1. UL916 PAZX, Open Energy Management Equipment
 - 2. UL94-5V, Flammability
 - 3. FCC Part 15, Subpart B, Class B Limit
 - 4. BACnet Testing Laboratory (BTL) listed

2.9 INPUT/OUTPUT INTERFACE:

- A. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or

normally closed operation.

- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.10 POWER SUPPLIES:

- A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA approved.

2.11 AUXILIARY CONTROL DEVICES:

- A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
 - 2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
 - 3. Damper shaft bearings shall be as recommended by manufacturer for application.

4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless-steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
 5. All leakage testing and pressure ratings will be based on AMCA Publication 500.
 6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.
- C. Electric damper/valve actuators
1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
 3. All rotary spring return actuators shall be capable of clockwise or counterclockwise spring return operation. Linear actuators shall spring return to the retracted position.
 4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
 5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
 6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
 7. Actuators shall be Underwriters Laboratories Standard 873 listed.
 8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- D. Control Valves
1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.
 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Water Valves:
 - 1) Two-way: 150% of total system (pump) head.
 - 2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - b. Steam Valves: 150% of operating (inlet) pressure.
- E. Water Valves
1. Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal

- percentage ports for modulating service.
2. Sizing Criteria:
 - a. Two-position service: Line size.
 - b. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 34.5 kPa (5 psi), whichever is greater.
 - c. Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 34.5 kPa (5 psi) maximum.
 - d. Valves DN 15 (1/2 in.) through DN 50 (2 in.) shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless-steel ball.
 - e. Valves DN 65 (2 1/2 in.) and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
 3. Water valves shall fail normally open or closed, as scheduled on plans, or as follows:
 - a. Water zone valves—normally open preferred
 - b. Heating coils in air handlers - normally open
 - c. Chilled-water control valves - normally closed
 - d. Other applications—as scheduled or as required by sequences of operation
 4. Zone valves shall be sized to meet the control application, and they shall maintain their last position in the event of a power failure.

F. Steam Valves

1. Body and trim materials shall be in accordance with manufacturer's recommendations for design conditions and service with linear ports for modulating service.
2. Sizing Criteria:
 - a. Two-position service: pressure drop 10% to 20% of inlet psig
 - b. Modulating service: 100 kPa (15 psig) or less; pressure drop 80% of inlet psig
 - c. Modulating service: 101 to 350 kPa (16 to 50 psig); pressure drop 50% of inlet psig
 - d. Modulating service: over 350 kPa (50 psig); pressure drop as scheduled on plans

G. Binary Temperature Devices

1. Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
2. Line-voltage space thermostat shall be bimetal-actuated, open contact type, or

bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

3. Low-limit thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type, with an element of 6 m (20 ft) minimum length. Element shall respond to the lowest temperature sensed by any 30 cm (1 ft) section. The low-limit thermostat shall be manual reset only.

H. Wired Temperature Sensors

1. Temperature sensors shall be RTD or thermistor.
2. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m² (10 ft²) of duct cross section.
3. Immersion sensors shall be provided with a separable stainless-steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.
4. Space sensors shall be equipped with setpoint adjustment, override switch, display, and/or communication port as shown on plans.
5. Provide matched temperature sensors for differential temperature measurement.

I. Wired Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80%.
2. Duct sensors shall be provided with a sampling chamber.

J. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
3. Water pressure sensor shall have stainless-steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
4. Water differential pressure sensor shall have stainless-steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

K. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

2.12 WIRING AND RACEWAYS:

- A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.
- B. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.
- C. Fiber Optic Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

PART 3 EXECUTION

3.0 SECTION INCLUDES

- 3.1 EXAMINATION:
- 3.2 PROTECTION:
- 3.3 COORDINATION:
- 3.4 GENERAL WORKMANSHIP:
- 3.5 FIELD QUALITY CONTROL:
- 3.6 COMMUNICATION WIRING:
- 3.7 FIBER OPTIC CABLE:
- 3.8 INSTALLATION OF SENSORS:
- 3.9 FLOW SWITCH INSTALLATION:
- 3.10 WARNING LABELS:
- 3.11 IDENTIFICATION OF HARDWARE AND WIRING:
- 3.12 CONTROLLERS:
- 3.13 PROGRAMMING:
- 3.14 CONTROL SYSTEM CHECKOUT AND TESTING:
- 3.15 CLEANING:
- 3.16 TRAINING:

3.1 EXAMINATION:

- A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Engineer for resolution before rough-in work is started.
- B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

3.2 PROTECTION:

- A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.
- B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION:

- A. Site
 - 1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
 - 2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- B. Submittals. Refer to the "Submittals," section of this specification for requirements.
- C. Test and Balance
 - 1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
 - 2. The contractor shall provide training in the use of these tools. This training will be planned for a duration of 4 hours.
 - 3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
 - 4. The tools used during the test and balance process shall be returned to the

contractor at the completion of the testing and balancing.

D. Life Safety

1. Duct smoke detectors required for air handler shutdown shall be supplied under Section 26100 of this specification. The contractor shall interlock smoke detectors to air handlers for shutdown as described in the Sequences of Operation for this project.
2. Smoke dampers and actuators required for duct smoke isolation are provided under Section 26100. The contractor shall interlock these dampers to the air handlers as described in the Sequences of Operation for this project as applicable.
3. Fire/smoke dampers and actuators required for fire rated walls are provided under another Section 26100. Control of these dampers shall be by 26100

E. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. All communication media and equipment shall be provided as specified in the "Communication" section of this specification.
2. Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

3.4 GENERAL WORKMANSHIP:

- A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.
- E. All control device installation and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

3.5 FIELD QUALITY CONTROL:

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Contract Documents.
- B. BAS manufacturer shall continually monitor the field installation for building code compliance and quality of workmanship. All visible piping and wiring runs shall be installed parallel to building lines and properly supported.
- C. BAS installing Contractor(s) shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.6 COMMUNICATION WIRING:

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- E. When a cable enters or exits a building, a lightning arrestor must be installed between the line and ground.
- F. All runs of communication wiring shall be unspliced length when the length is commercially available.
- G. All communication wiring shall be labeled to indicate origin and destination.

3.7 FIBER OPTIC CABLE:

- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.
- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.8 INSTALLATION OF SENSORS:

- A. Sensors required for mechanical equipment operation shall be factory installed and wired as specified in mechanical equipment specifications. BAS manufacturer shall be responsible for coordinating these control devices and ensuring the sequence of operations will be met. Installation and wiring shall be in accordance with the BAS manufacturer's recommendations.
- B. Sensors that require field mounting shall meet the BAS manufacturer's recommendations and be coordinated with the mechanical equipment they will be associated.
- C. Mount sensors rigidly and adequately for the environment the sensor will operate.
- D. Room temperature sensors shall be installed on concealed junction boxes properly supported by the block wall framing. For installation in dry wall ceilings, the low voltage sensor wiring can be installed exposed and must meet applicable National and Local Electrical Codes.
- E. All wires attached to wall mounted sensors shall be sealed off to prevent air from transmitting in the associated conduit and affecting the room sensor readings.
- F. Install duct static pressure tap with tube end facing directly down-stream of air flow.
- G. Install space static pressure sensor with static sensing probe applicable for space installation where applicable.
- H. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- I. All pipe mounted temperature sensors shall be installed in matched thermowells. Install all liquid temperature sensors with heat conducting fluid in thermal wells for adequate thermal conductance.
- J. Wiring for space sensors shall be concealed in building drywall. EMT conduit is acceptable within mechanical equipment and service rooms.
- K. Install outdoor air temperature sensors on north wall complete with sun shield at manufacturer's recommended location and coordinated with Engineer.

3.9 FLOW SWITCH INSTALLATION:

- A. Coordinate installation of flow switch with Mechanical Contractor who will be responsible for installing a thread o let in steel piping applications. Copper pipe applications will require the use CxCxF Tee, and no pipe extensions or substitutions will be allowed.
- B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream, or two feet, whichever is greater, from pipe fittings and other inline potential obstructions.

- C. Install in accordance with manufacturers' instructions, which will require proper flow direction, horizontal alignment with flow switch mounting on the top of pipe.

3.10 WARNING LABELS:

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS system.
- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

3.11 IDENTIFICATION OF HARDWARE AND WIRING:

- A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.
- C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.
- D. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.12 CONTROLLERS:

- A. Provide a separate DDC Controller for individual HVAC mechanical equipment. BAS manufacturer shall furnish and coordinate DDC controllers and control devices and ensure that installation and wiring adhere to BAS manufacturer's design recommendations. For those mechanical equipment units that do not have factory installed controls specified, the BAS manufacturer shall field mount controls and coordinate all installation and termination information to ensure the specified sequence of operations are met.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.
 - 1. Future use of spare I/O point capacity shall require providing the field instrument and control device, field wiring, engineering, programming, and commissioning. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.13 PROGRAMMING:

- A. Provide sufficient internal memory for all controllers to ensure specified sequence of operations, alarming, trending, and reporting requirements are achieved. BAS manufacturer shall provide a minimum of 25% spare memory capacity for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
 - 1. Provide programming for individual mechanical systems to achieve all aspects of the sequence of operation specified. It is the BAS manufacturer's responsibility to ensure all mechanical equipment functions and operates as specified in sequence of operations. Provide sufficient programming comments in controller application software to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.
- D. BAS Operator's Interface
 - 1. When Operator Workstation is specified, provide color graphics for each piece of mechanical equipment depicting sufficient I/O to monitor and troubleshoot operation. Operator color graphics shall include Chiller Plant, Cooling Tower System, Boiler Plant, Air Handling Units, Rooftop Units, VAV Terminal Boxes, Fan Coil Units, Unit Ventilators, Heat Exchangers, Exhaust Fans, etc. These standard graphics shall depict all points dynamically as specified in the points list and/or indicated in sequence of operation.
 - 2. The BAS manufacturer shall provide all the labor necessary to install, initialize, start up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.
 - 3. As part of this execution phase, the BAS manufacturer shall perform a complete test of the operator interface.

3.14 CONTROL SYSTEM CHECKOUT AND TESTING:

- A. Start-up testing. All testing in this section shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.
 - 1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all of the instruments, controls, and accessory equipment furnished under this specification.
 - 2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - 3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturer's recommendations.

4. Verify all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starter, etc.) operate properly and normal positions are correct.
5. Verify all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimal start/stop routines.
7. Alarms and Interlocks
 - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
 - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
 - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.15 CLEANING:

- A. The BAS manufacturer's installing contractor(s) shall clean up all debris resulting from their installation activities on a daily basis. The installation contractors shall remove all cartons, containers, crates, etc. under their control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Owner, Construction Manager, General Contractor, and/or Mechanical Contractor.
- B. At the completion of work in any area, the installation contractor shall clean all of their work, equipment, etc., making it free from dust, dirt and debris.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage. Any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.16 TRAINING:

- A. Provide minimum of (4) hours of operator training throughout the contract period. The training will be provided for personnel designated by the Owner.
- B. These objectives will be divided into logical groupings; participants may attend one or more of these, depending on level of knowledge required:
 1. Day-to-day BAS Operators
 2. BAS Troubleshooting & Maintenance

END OF SECTION

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tubes, and fittings.
2. Mechanical couplings.
3. Piping specialties.
4. Gas valves.

B. Related Requirements:

1. Section 231126 "Facility Liquefied-Petroleum Gas Piping."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings: Provide plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service-meter assembly and pressure regulator assembly.

C. Delegated Design Submittals: Comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

- C. Seismic Qualification Data: Submit certification that vaporizer, air mixer, storage container supports, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Welding Certificates: For steel supports and piping.
- E. Field Quality Control Reports: For specified tests and inspections.
- F. Qualification Statements: For factory-authorized service representative.
- G. Delegated Design Engineer Qualifications: For design of restraints and anchors for LPG piping and equipment.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic gas shutoff valves pressure regulators and service meters.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer to train Owner personnel.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in Florida where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Steel Support Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Pipe Welding Qualifications: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 54 and the 2023 Florida Fuel Gas Code for natural-gas distribution system, including materials, installation, and testing.
- B. Comply with requirements of authorities having jurisdiction.

- C. Comply with requirements of utility company supplying natural-gas.
- D. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum.
 - 2. Service Regulators: 65 psig minimum.
 - 3. Service Meter: 5 psig.
- E. Natural-Gas System Pressure within Buildings:
 - 1. Single Pressure: 0.5 psig or less.
 - 2. Two Pressure Ranges, Not More Than 2 psig (13.8 kPa): Primary pressure is more than **0.5 psig** but not more than **2 psig** and is reduced to secondary pressure of **0.5 psig** or less.
 - 3. Two Pressure Ranges, Not More Than 5 psig (34.5 kPa): Primary pressure is more than **2 psig** but not more than **5 psig** and is reduced to secondary pressure of more than **0.5 psig**, but not more than **2 psig**.
 - 4. Three Pressure Ranges: Primary pressure is more than **2 psig** but not more than **5 psig** is reduced to secondary pressures of more than **0.5 psig** but not more than **2 psig** and is reduced again to pressures of **0.5 psig** or less.
- F. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PIPE, TUBES, AND FITTINGS

- A. Steel Pipe and Fittings:
 - 1. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 3. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 - 4. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 5. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Unacceptable for underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless-

steel underground.

6. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.3 MECHANICAL COUPLINGS

A. Mechanical Coupling - Steel:

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. Smith-Blair, a Xylem brand.
2. Source Limitation: Obtain couplings from single manufacturer.
3. Flanges and Tube: Stainless-steel with epoxy finish.
4. Seals: NBR.
5. Bolts, Washers, and Nuts: Stainless-steel.
6. Factory-installed anode for steel-body couplings installed underground.
7. Application: Suitable for joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

2.4 PIPING SPECIALTIES

A. Y-Pattern Strainer:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for **NPS 2** and smaller; flanged ends for **NPS 2-1/2** and larger.
3. Strainer Screen: 40 -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: **125 psig**.

2.5 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: AWS D10.12/D10.12M.
- C. Brazing Filler Metals: AWS A5.8/A5.8M alloy with melting point greater than **1000 deg F**. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.6 GAS VALVES

A. Manual Gas Shutoff Valve - Metallic:

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. A.Y. McDonald Mfg. Co.
 - b. Apollo Valves; a brand of Aalberts Integrated Piping Systems (Aalberts Industries)
 - c. BrassCraft Manufacturing Co.; a Masco company
 - d. Jenkins Valves; a Crane Co. brand
 - e. Jomar Valve
 - f. Mueller Co.; Gas Products Division; a subsidiary of Mueller Gas Products Inc.
 - g. NIBCO INC.
 - h. Stockham; a Crane Co. brand
2. Source Limitation: Obtain metallic manual gas shutoff valves from single manufacturer.
3. Description: Metallic ball valve or metallic plug valve of type indicated in schedules under Part 3.
4. Standards:
 - a. CSA/ANSI Z21.15/CSA 9.1.
 - b. ASME B16.33.
 - c. ASME B16.44.
5. System Pressure Rating: 0.5 psig or less.
6. Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service Mark: Initials "WOG" permanently marked on valve body.
8. End Connections:
 - a. Threaded Ends: ASME B1.20.1.
 - b. Dryseal Threads on Flare Ends: ASME B1.20.3.
 - c. Flanged Ends: ASME B16.5 for steel flanges.
9. Tamperproof locking feature.

2.7 DIELECTRIC FITTINGS

- ### **A. Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.**

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE, TUBES, AND FITTINGS

- A. Outdoor Piping: Comply with NFPA 54 and the 2023 Florida Fuel Gas Code, and authorities having jurisdiction requirements for installation and purging of natural-gas piping.
 - 1. Install underground, natural-gas piping buried at least 18 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - a. If natural-gas piping is installed less than **12 inches** below finished grade, install it in containment conduit.
 - 2. Install underground, PE, natural-gas piping in accordance with ASTM D2774.
 - 3. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - c. Replace pipe having damaged PE coating with new pipe.
 - 4. Copper Tubing with Protective Coating:
 - a. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 5. Install fittings for changes in direction and branch connections.
 - 6. Joints for connection to inlets and outlets on regulators, and valves may be flanged or threaded to match the equipment.
 - 7. Install pressure gauge upstream and downstream from each service regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."
- B. Indoor Piping: Comply with NFPA 54 and the 2023 Florida Fuel Gas Code and authorities having jurisdiction requirements for installation and purging of natural-gas piping.
 - 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 - 2. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
 - 3. Install piping in concealed locations unless otherwise indicated on Drawings. Piping in equipment rooms and service areas may be installed exposed. Piping is

not to be installed in inaccessible locations.

- a. Conceal piping in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- b. Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit in accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1) Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - a) Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 - 2) In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of **1-1/2 inches** of concrete. Piping may not be in physical contact with other metallic structures, such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3) In Floor Channels: Channels must have cover and be open to space above cover for ventilation.
 - 4) In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a) Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5) Prohibited Locations:
 - a) Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b) Do not install natural-gas piping in return-air plenums.
 - c) Do not install natural-gas piping in solid walls or partitions.
 - 6) Under the Building: Install in vented containment conduit or CSST with integral vented sleeve and associated fittings.
4. 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 on Drawings.
5. Locate valves for easy access from a standing position. Do not locate valves within return air plenums.

6. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
7. Install piping free of sags and bends.
8. Install fittings for changes in direction and branch connections.
9. Comply with requirements in Sections specifying gas-fired appliances and equipment, and verify final appliance and equipment locations for roughing-in requirements.
10. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - a. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of three pipe diameters, but not less than **3 inches** long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
 - b. Install sediment trap on both sides of regulators for gas reduction to **2 psig** with valve and cap.
11. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors, and terminate with weatherproof vent cap.
12. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
13. Connect branch piping from top or side of horizontal piping.
14. Install unions in pipes **NPS 2** and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
15. Do not use natural-gas piping as grounding electrode.
16. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve. Remove and replace startup strainer with new strainer prior to final acceptance tests.
17. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."
18. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."
19. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."
20. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.2 INSTALLATION OF GAS VALVES

- A. Install manual gas shutoff valve for each gas appliance ahead of CSST, aluminum, or

copper connector.

- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- F. Do not install valves in return-air plenums.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- C. Metal Tube or Pipe:
 - 1. Install hangers for metal tube or pipe with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - 2. Support vertical runs of steel piping and copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. CSST:
 - 1. Install hangers for CSST, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - 2. Support vertical runs of CSST to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.

3.4 INSTALLATION OF LABELING AND IDENTIFICATION

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Label and identify gas piping and pressure outside a multitenant building by tenant.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Comply with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction requirements for testing, inspection, and purging of natural-gas installation.
2. Natural-gas installation will be considered defective if it does not pass tests and inspections. Defective products are to be replaced. Retest installation after defective products have been replaced for code compliance.

B. Prepare test and inspection reports.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.7 OUTDOOR NATURAL-GAS PIPING SCHEDULE

A. Underground Natural-Gas Piping: To be one of the following:

1. PE Pipe, Tubing and Fittings: Terminate service-line risers with tracer wire in an accessible location.
2. Steel Pipe: With wrought-steel welding fittings or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
3. Drawn-Temper Copper Tube: With copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
4. Annealed-Temper Copper Tube: With copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
5. Containment Conduit: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.

B. Aboveground Natural-Gas Piping: To be one of the following:

1. CSST and fittings.
2. Steel Pipe: With malleable-iron threaded fittings.
3. Drawn-Temper Copper Tube: With wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
4. Annealed-Temper Copper Tube: With wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

3.8 INDOOR NATURAL-GAS PIPING SCHEDULE FOR SYSTEM PRESSURES LESS

THAN 0.5 PSIG (3.45 KPA)

- A. Aboveground Branch Piping NPS 1 (DN 25) and Smaller: To be one of the following:
 - 1. CSST and fittings.
 - 2. Tin-Lined Copper Tube: With flared joints and fittings.
 - 3. Annealed-Temper Copper Tube: With wrought-copper fittings and brazed joints.
 - 4. Aluminum Tube: With flared fittings and joints.
 - 5. Steel Pipe: With malleable-iron threaded fittings.
- B. Aboveground Distribution Piping: To be one of the following:
 - 1. Steel pipe with malleable-iron threaded fittings.
 - 2. Steel pipe with wrought-steel welding fittings.
 - 3. Drawn-Temper Copper Tube: With wrought-copper fittings and brazed joints.
- C. Underground Below-Building Piping:
 - 1. Steel Pipe: With malleable-iron threaded fittings.
 - 2. Steel pipe with wrought-steel welding fittings.
 - 3. Containment Conduit: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.
 - 4. Containment Conduit Vent Piping: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.

3.9 INDOOR NATURAL-GAS PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 KPA) AND LESS THAN 5 PSIG (34.5 KPA)

- A. Aboveground Branch Piping NPS 1 (DN 25) and Smaller: To be one of the following:
 - 1. CSST and fittings.
 - 2. Tin-Lined Copper Tube: With flared joints and fittings.
 - 3. Annealed-Temper Copper Tube: With wrought-copper fittings and brazed joints.
 - 4. Aluminum Tubing and Piping: With flared fittings and joints.
 - 5. Steel Pipe: With malleable-iron threaded fittings.
- B. Aboveground Distribution Piping:
 - 1. Steel Pipe: With malleable-iron threaded fittings.
 - 2. Drawn-Temper Copper Tube: With wrought-copper fittings and brazed joints.
- C. Underground Below-Building Piping:
 - 1. Steel Pipe: With malleable-iron threaded fittings.
 - 2. Containment Conduit: In accordance with NFPA 54, the 2023 Florida Fuel Gas

- Code and authorities having jurisdiction.
3. Containment Conduit Vent Piping: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.

3.10 INDOOR NATURAL-GAS PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG (34.5 KPA)

- A. Aboveground Piping: Maximum operating pressure more than 5 psig.
- B. Aboveground, Branch Piping:
 1. Steel Pipe: With wrought-steel welding fittings.
- C. Aboveground Distribution Piping: To be one of the following:
 1. Steel Pipe: With wrought-steel welding fittings.
 2. Drawn-Temper Copper Tube: With wrought-copper fittings and brazed joints.
- D. Underground Below-Building Piping:
 1. Steel Pipe: With malleable-iron threaded fittings.
 2. Steel pipe with wrought-steel welding fittings.
 3. Containment Conduit: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.
 4. Containment Conduit Vent Piping: In accordance with NFPA 54, the 2023 Florida Fuel Gas Code and authorities having jurisdiction.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 1. Manual gas shutoff ball valve - PE.
 2. Manual gas shutoff valve - metallic.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Aboveground Natural-Gas Piping: Manual gas shutoff valve - metallic.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings, factory fabricated - single wall.
2. Rectangular ducts and fittings, shop fabricated - single wall.
3. Rectangular ducts and fittings, factory fabricated - double wall.
4. Round ducts and fittings, factory fabricated - single wall.
5. Round ducts and fittings, factory fabricated - double wall.
6. Sheet metal materials.
7. Sealants and gaskets.
8. Hangers and supports.
9. Strut support system for ductwork - metal, cable type.

B. Related Requirements:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 230800 "Commissioning of HVAC" for HVAC commissioning procedures.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings:

1. Duct layout indicating sizes, configuration, liner material, and static-pressure and leakage classes.
2. Elevation of top of ducts.
3. Dimensions of duct runs from building grid lines.
4. Fittings.
5. Reinforcement and spacing.
6. Seam and joint construction.
7. Penetrations through fire-rated and other partitions.
8. Equipment installation based on equipment being used on Project.
9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
10. Hangers and supports, including methods for duct and building attachment and

vibration isolation.

11. Sealants and Gaskets: Including materials and code compliance.

1.3 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: For specified tests and inspections.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.
- B. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless specifically indicated otherwise on the Drawings, all duct dimensions indicated on the Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts and Fittings, Factory Fabricated - Single Wall:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC
 - b. MKT Metal Manufacturing
 - c. SHAPE Manufacturing Inc.
 - d. Sheet Metal Connectors, Inc.
 2. Source Limitations: Obtain single-wall, factory-fabricated rectangular ducts and fittings from single manufacturer.
 3. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static-pressure ratings indicated on Drawings.
 - a. Material, Indoor Ductwork: See Part 3 "Duct Application Schedule" Article for indoor duct materials applications.
 - b. Material, Ductwork Exposed to Weather: For ducts exposed to weather, construct of Type 304 stainless-steel indicated by manufacturer in writing to be suitable for outdoor installation.

4. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 5. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.
 6. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Rectangular Ducts and Fittings, Shop Fabricated - Single Wall:
1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static pressure indicated on Drawings.
 - a. Material, Indoor Ductwork: See Part 3 "Duct Application Schedule" Article for indoor duct material applications.
 - b. Material, Ductwork Exposed to Weather: For ducts exposed to weather, construct with joints and other details in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," suitable for outdoor use.
 2. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct Transverse/Transverse Joints," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in

SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.

4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Rectangular Ducts and Fittings, Factory Fabricated - Double Wall:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC
 - b. MKT Metal Manufacturing
 - c. SHAPE Manufacturing Inc.
 - d. Sheet Metal Connectors, Inc.
2. Source Limitations: Obtain double-wall, factory-fabricated rectangular ducts and fittings from single manufacturer.
3. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.
4. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static pressure indicated on the Drawings.
 - a. Material, Indoor Ductwork: See Part 3 "Duct Application Schedule" Article for indoor duct material applications.
 - b. Material, Ductwork Exposed to Weather: For ducts exposed to weather, construct outer duct of Type 304 stainless-steel indicated by manufacturer in writing to be suitable for outdoor installation.
5. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
6. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in

SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.

7. Interstitial Insulation, Flexible Elastomeric: Duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
8. Inner Duct: Minimum 24-gauge solid galvanized sheet steel.

2.3 ROUND DUCTS AND FITTINGS

A. Round Ducts and Fittings, Factory Fabricated - Single Wall:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. DMI Companies
 - b. DMI Companies (GreenSeam)
 - c. Elgen Manufacturing
 - d. McGill AirFlow LLC
 - e. MKT Metal Manufacturing
 - f. SEMCO, LLC; part of FlaktGroup
 - g. Set Duct Manufacturing
 - h. SHAPE Manufacturing Inc.
 - i. Sheet Metal Connectors, Inc.
 - j. Spiral Manufacturing Co., Inc.
2. Source Limitations: Obtain single-wall, factory-fabricated round ducts and fittings from single manufacturer.
3. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static pressure indicated in "Duct Application Schedule" Article.
 - a. Material, Indoor Ductwork: See Part 3 "Duct Application Schedule" Article for indoor duct material applications.
 - b. Material, Ductwork Exposed to Weather: For ducts exposed to weather, construct of Type 304 stainless-steel indicated by manufacturer in writing to be suitable for outdoor installation.
4. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Provide flanged joints for transverse joints in ducts larger than 60 inches in diameter.
5. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-

2, "Round Duct Longitudinal Seams," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

6. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Round Ducts and Fittings, Factory Fabricated - Double Wall:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DMI Companies
 - b. McGill AirFlow LLC
 - c. MKT Metal Manufacturing
 - d. SEMCO, LLC; part of FlaktGroup
 - e. Set Duct Manufacturing
 - f. SHAPE Manufacturing Inc.
 - g. Sheet Metal Connectors, Inc.
2. Source Limitations: Obtain double-wall, round ducts and fittings from single manufacturer.
3. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static pressure indicated on the Drawings.
 - a. Material, Indoor Ductwork: Construct ducts of galvanized sheet steel.
 - b. Material, Ductwork Exposed to Weather: For ducts exposed to weather, construct outer duct of Type 304 stainless-steel indicated by manufacturer in writing to be suitable for outdoor installation.
4. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Provide flanged joints for transverse joints in ducts larger than 60 inches in diameter.
5. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in

SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
6. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static pressure, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
7. Inner Duct: Minimum 24-gauge.
 - a. Solid galvanized sheet steel.
8. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124.
 - a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - c. Coat insulation with antimicrobial coating.
 - d. Cover insulation with polyester film complying with UL 181, Class 1.
9. Interstitial Insulation, Flexible Elastomeric: Duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
 3. Lockforming Quality: Sheet steel and galvanized coating is to be able to be formed with back-to-back bends in seams such as the Pittsburgh lock at high speed without cracking or flaking of the coating on the outside of the bend.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 1. Galvanized Coating Designation: G90.
 2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal

- surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Application Schedule" Article; cold rolled, annealed, sheet. Provide exposed surface finish No. 2B, No. 2D, No. 3, or No. 4, as indicated in "Duct Application Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B209/B209M Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Factory- or Shop-Applied Antimicrobial Coating:
1. Apply to the surface of sheet metal that will form the interior surface of the duct. Provide untreated clear coating is to be applied to the exterior surface.
 2. Provide antimicrobial compound tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Provide coating containing the antimicrobial compound having hardness of 2H, minimum, when tested in accordance with ASTM D3363.
 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 5. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- H. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- I. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

- A. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.
- B. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Transversely Oriented Liner Edges Facing the Airstream: Secure with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets: Maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723 and certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static Pressure: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static Pressure: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static Pressure: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single component, acid curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene

plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Provide seal having maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for 10-inch wg static pressure, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

1. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

- a. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

2. Steel Cables for Stainless-steel Ducts: Stainless-steel complying with ASTM A492.

- a. Stainless-steel Cable End Connections: Stainless-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes complying with ASTM A36/A36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

F. Strut Support System for Ductwork - Metal, Cable Type:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Gripple Inc.

- b. nVent
- 2. Source Limitations: Obtain metal cable type strut support system for ductwork from single manufacturer.
- 3. Description: Factory-fabricated ductwork support system consisting of cable clamps, slotted channel brackets, wire-rope suspension components, and associated accessories for a complete ductwork suspension system. No tools required for manual assembly in the field to support ductwork routing.
- 4. Components:
 - a. Brackets: Slotted steel channels furnished in pre-cut lengths to suit specific system application for Project.
 - b. Suspension Components: Hanging cables with adjustable fasteners.
 - 1) Wire Rope: High-tensile-steel wire rope, complying with ASTM A1023/A1023M; lengths, diameters, and wire construction to accommodate design loads.
 - a) Foot attachment type to suit application.
 - b) End Fix Type: Loop, strap hook, eyelet.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTS

- A. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a minimum clearance of 1 inch, plus allowance for insulation thickness.
- H. Do not route ducts through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation

with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- J. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- L. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- M. Branch Connections: Use lateral or conical branch connections.
- N. Installation of Metal, Cable-Type Strut Support System for Ductwork: Install in accordance with manufacturer's written installation instructions.

3.2 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.
- C. Two-Part Tape Sealing System: Acceptable.
- D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless-steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- E. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets. Remove all stickers and other installation markings.
- F. Repair or replace damaged sections and finished work that do not comply with these requirements.

3.3 ADDITIONAL REQUIREMENTS FOR DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Ductwork Exterior Surface Treatment:

1. Single Wall:
 - a. If galvanized duct is indicated in "Duct Application Schedule" Article and if outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 099113 "Exterior Painting."
 - b. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."
 2. Double Wall:
 - a. If galvanized duct is indicated in "Duct Application Schedule" Article, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 099113 "Exterior Painting."
- D. Material: See "Duct Application Schedule" Article for duct materials.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Application Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Minimum Seal Class: Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 1. Outdoor, Supply-Air Ducts: Seal Class A.
 2. Outdoor, Exhaust Ducts: Seal Class A.
 3. Outdoor, Return-Air Ducts: Seal Class A.
 4. Unconditioned Space, Supply-Air Ducts in Pressure Rating of 2-Inch wg (500 Pa) and Lower: Seal Class B.
 5. Unconditioned Space, Supply-Air Ducts in Pressure Rating Higher than 2-Inch wg (500 Pa): Seal Class A.
 6. Unconditioned Space, Exhaust Ducts: Seal Class C.
 7. Unconditioned Space, Return-Air Ducts: Seal Class B.
 8. Conditioned Space, Supply-Air Ducts in Pressure Ratings of 2-Inch wg (500 Pa) and Lower: Seal Class C.
 9. Conditioned Space, Supply-Air Ducts in Pressure Rating Higher than 2-Inch wg (500 Pa): Seal Class B.
 10. Conditioned Space, Exhaust Ducts: Seal Class B.
 11. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 ft.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 DUCTWORK CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. For painting of interior exposed metal ducts, see Section 099123 "Interior Painting."
- C. For painting of exterior metal ducts, see Section 099113 "Exterior Painting."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Duct System Cleanliness Test Procedure:
 - a. Visually inspect duct system to ensure that no visible contaminants are present.
 - b. Test sections of metal duct system, chosen randomly by Owner.
 - 2. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use duct cleaning methodology as indicated in NADCA ACR.
- C. Use service openings for entry and inspection.
 - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- D. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- E. Cleaning: Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers

and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

F. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.10 DUCT APPLICATION SCHEDULE

- A. Fabricate all ducts to achieve SMACNA pressure rating, seal class, and leakage class as indicated below.
- B. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units: All RTUs
 - a. Pressure Rating: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - e. Material: Type G90 galvanized steel.
 2. Ducts Connected to Constant-Volume Air-Handling Units: Gymnasium Units
 - a. Pressure Rating: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.

- d. Material: Fabric.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units: All RTUs
 - a. Pressure Rating: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - e. Material: Type G90 galvanized steel.
2. Ducts Connected to Air-Handling Units: Gymnasium Units
 - a. Pressure Rating: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - e. Material: Type G90 galvanized steel.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air: All Exhaust Fans
 - a. Pressure Rating: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - e. Material: Type G90 galvanized steel.

E. Double-Wall Duct Interstitial Insulation:

1. Supply-Air Ducts: 2 inches thick.
2. Return-Air Ducts: 2 inches thick.
3. Exhaust-Air Ducts: 2 inches thick.

F. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm (5 m/s) or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to-Diameter Ratio: 1.5.
 - b. Round and Flat Oval Elbows:
 - 1) Stamped or pleated for 12 inches and smaller diameters.
 - 2) Standing seam for 14 inches and larger diameter.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Turning vanes.
 - 5. Remote damper operators.
 - 6. Duct-mounted access doors.
 - 7. Duct access panel assemblies.
 - 8. Duct flexible connectors.
 - 9. Duct accessory hardware.
 - 10. Flexible ducts.
 - 11. Flexible duct connectors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
 - 1. Construction details, material descriptions, and dimensions of individual components.
 - 2. For dampers, include housings, linkages, and operators.
 - 3. For damper operators, include electrical or pneumatic pressure rating and damper size rating.
- B. Shop Drawings: For air duct accessories.
 - 1. Plans showing locations, elevations, sections, and attachment details.
 - 2. Duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, on

which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

- B. Source Quality Control Reports: For duct-mounted duct silencers.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories.

PART 2 - PRODUCTS

2.1 DAMPERS

- A. Backdraft and Pressure Relief Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Greenheck Fan Corporation
 - b. Nailor Industries Inc
 - c. Pottorff
 - d. Ruskin; Air Distribution Technologies, Inc.
 - 2. Description: Gravity balanced with adjustable counterweight or with spring.
 - 3. General Requirements:
 - a. Maximum Air Velocity: 1000 fpm.
 - b. Maximum System Pressure: 1 inch wg.
 - c. AMCA Certification: Test and rate in accordance with AMCA 511.
 - d. Leakage:
 - 1) Class IA: Leakage is not to exceed 3 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 2) Class I: Leakage is not to exceed 4 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 3) Class II: Leakage is not to exceed 10 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 4) Class III: Leakage is not to exceed 40 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 4. Construction:
 - a. Frame: Hat shaped, with welded or mechanically attached corners.
 - 1) Material: 16-gauge- thick, galvanized sheet steel.
 - b. Blades: Multiple single-piece blades, center pivoted, with sealed edges.

- 1) Maximum Blade Width: 6-inch.
 - 2) Material: 16-gauge- thick, galvanized sheet steel.
 - 3) Action: Parallel.
 - 4) Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
 - 5) Axles:
 - a) Material: Galvanized steel Stainless-steel.
 - b) Diameter: 0.20 inch.
 - c. Tie Bars and Brackets: Galvanized steel.
 - d. Counterbalance: Adjustable counterweight.
 - e. Bearings: Brass sleeve.
5. Damper Actuator - Electric:
 - a. Electrical Voltage: 24 V ac.
 - b. UL Rating: UL 60730-2-14 and UL 2043 plenum rated.
 - c. Actuator Type: with fail-safe spring return.
 - 1) Sufficient motor torque to drive damper fully closed with adequate force to achieve required damper seal.
 - 2) Minimum 90-degree drive rotation.
 - d. Drive Rotation: Clockwise or counterclockwise as required for application.
 - e. Environmental Operating Range:
 - 1) Temperature: Minus 40 to plus 130 deg F.
 - 2) Humidity: 5 to 95 percent relative humidity noncondensing.
 - f. Environmental Enclosure: NEMA 2.
 - g. Actuator to be factory mounted and provided with a single-point wiring connection.
6. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923.02 "BACnet Direct Digital Control for HVAC and Other Building Control Systems."
 - a. Electrical Connection: 24 V, 60 Hz.
7. Accessories:
 - a. Adjustment Device: To permit setting for varying differential static pressure.
 - b. Counterweights and Spring-Assist Kits: For vertical airflow installations.
 - c. Chain pulls.
 - d. 90-degree stops.
 - e. Screen:
 - 1) Mounting: mounted in sleeve.
 - a) Sleeve Thickness: 20 gauge minimum.

b) Sleeve Length: 6 inches minimum.

- 2) Material: Galvanized steel.
- 3) Type: Bird.

B. Control Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Carnes Company
- b. Greenheck Fan Corporation
- c. Nailor Industries Inc
- d. Pottorff
- e. Ruskin; Air Distribution Technologies, Inc.

2. General Requirements:

- a. Suitable for horizontal or vertical airflow applications.
- b. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
- c. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
- d. AMCA Certification: Test and rate in accordance with AMCA 511.
- e. Leakage:
 - 1) Class IA: Leakage is not to exceed 3 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 2) Class I: Leakage is not to exceed 4 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 3) Class II: Leakage is not to exceed 10 cfm/sq. ft. against 1 inch wg differential static pressure.
 - 4) Class III: Leakage is not to exceed 40 cfm/sq. ft. against 1 inch wg differential static pressure.
- f. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
- g. Velocity: Up to 3000 fpm.
- h. Temperature: Minus 25 to plus 180 deg F.
- i. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

3. Construction:

- a. Frames: Hat, U, or angle shaped. Provide flanges for attaching to walls and flangeless frames for installing in ducts.
 - 1) Material: 0.08-inch- thick extruded aluminum.
 - 2) Corners: Mitered and welded.

- b. Blades: Multiple blades. Vertical blades to have thrust bearings at each end of every blade.
 - 1) Material: Galvanized steel Aluminum.
 - 2) Material Thickness: 16-gauge- thick single skin.
 - 3) Maximum Blade Width: 6 inches.
 - 4) Action: Parallel or Opposed blade design.
 - 5) Edging Seals: Replaceable closed-cell neoprene.
 - 6) Jamb Seals: Flexible stainless-steel, compression type.
 - 7) Axles: 1/2-inch diameter; galvanized steel.
 - 8) Linkage: Enclosed within the frame and out of airstream.
 - 9) Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
 - c. Bearings: Oil-impregnated bronze.
- 4. Damper Actuator - Electric:
 - a. Electric - 24 V ac.
 - b. UL Rating: UL 60730-2-14 and UL 2043, plenum rated.
 - c. Actuator Type: with fail-safe spring return.
 - 1) Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - 2) Minimum 90-degree drive rotation.
 - d. Clockwise or counterclockwise drive rotation as required for application.
 - e. Environmental Operating Range:
 - 1) Temperature: Minus 40 to plus 130 deg F.
 - 2) Humidity: 5 to 95 percent relative humidity noncondensing.
 - f. Environmental Enclosure: NEMA 2.
 - g. Actuator to be factory mounted and provided with a single-point wiring connection.
- 5. Controllers, Electrical Devices, and Wiring:
 - a. Comply with requirements for electrical devices and connections specified in Section 230923.02 "BACnet Direct Digital Control for HVAC and Other Building Control Systems."
 - b. Electrical Connection: 24 V, 60 Hz.
- C. Manual Volume Dampers:
 - 1. Standard, Steel, Manual Volume Dampers:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Greenheck Fan Corporation

- 2) Nailor Industries Inc
- 3) Pottorff
- 4) Ruskin; Air Distribution Technologies, Inc.

b. General Requirements:

- 1) Suitable for horizontal or vertical airflow applications.
- 2) Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1 inch wg differential static pressure.

c. Construction:

- 1) Frames: Hat-shaped with mitered and welded corners. Provide flanges for attaching to walls and flangeless frames for installing in ducts.
 - a) Material: 16-gauge- thick, galvanized sheet steel.
- 2) Blades: Multiple or single blade. Stiffen damper blades for stability. Vertical blades to have thrust bearing at each end of every blade.
 - a) Material: Galvanized steel; 16 gauge thick.
 - b) Action: Parallel- or opposed-blade design.
 - c) Axles: Galvanized steel.
 - d) Linkage: Enclosed within the frame and out of airstream.
 - e) Locking Device: Holds damper blades in fixed position without vibration.
- 3) Bearings: Oil-impregnated bronze.
 - a) Tie Bars and Brackets: Galvanized steel.

2. Standard, Aluminum, Manual Volume Dampers:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Nailor Industries Inc
- 2) Pottorff
- 3) Ruskin; Air Distribution Technologies, Inc.

b. General Requirements:

- 1) Suitable for horizontal or vertical airflow applications.
- 2) Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1 inch wg differential static pressure.

c. Construction:

- 1) Frames: Hat shaped. Provide flanges for attaching to walls and flangeless frames for installing in ducts.

- a) Material: 0.10-inch- thick, aluminum sheet channels.
- 2) Blades: Multiple or single blade. Stiffen damper blades for stability. Vertical blades to have thrust bearing at each end of every blade.
 - a) Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - b) Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 - c) Action: Parallel- or opposed-blade design.
 - d) Axles: Galvanized steel.
 - e) Linkage: Enclosed within the frame and out of airstream.
 - f) Locking Device: Holds damper blades in a fixed position without vibration.
- 3) Bearings: Oil-impregnated bronze.
 - a) Tie Bars and Brackets: Aluminum.
- 3. Manual Volume Damper Jackshaft:
 - a. Size: 0.5-inch diameter.
 - b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- 4. Manual Volume Damper Hardware:
 - a. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - b. Include center hole to suit damper operating-rod size.
 - c. Include elevated platform for insulated duct mounting.

2.2 TURNING VANES

A. Turning Vane:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aero-Dyne Sound Control Co.
 - b. CL WARD & Family Inc.
 - c. DMI Companies
 - d. Duro Dyne Inc.
 - e. DynAir; a Carlisle Company
 - f. Elgen Manufacturing
 - g. Ward Industries; a brand of Hart & Cooley, LLC

2. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - a. Turning Vanes: Fabricate single -wall curved blades of galvanized steel.
 - b. Acoustic Turning Vanes: Fabricate airfoil-shaped extruded aluminum with perforated faces and fibrous-glass fill.
3. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
4. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
5. Vane Construction:
 - a. Wall: Single.
 - b. Single wall for ducts up to 36" wide and double wall for larger dimensions.

2.3 REMOTE DAMPER OPERATORS

- A. Remote Damper Operator:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DynAir; a Carlisle Company
 - b. METALAIRE, Inc
 - c. United Enertech Corp.
 - d. Young Regulator Company
 2. Description: Cable system designed for remote manual damper adjustment.
 3. Cable: Steel.
 4. Wall-Box Mounting: Recessed.
 5. Wall-Box Cover-Plate Material: Stainless-steel.

2.4 DUCT-MOUNTED ACCESS DOORS, ACCESS PANELS, AND PRESSURE-RELIEF DOORS

- A. Duct Access Panel Assemblies:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CL WARD & Family Inc.
 - b. DMI Companies
 - c. Flame Gard, Inc
 2. Panel and Frame: Minimum thickness 16-gauge carbon steel.

3. Fasteners: Carbon steel. Panel fasteners are not to penetrate duct wall.
4. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
5. Minimum Pressure Rating: 10 inches wg positive or negative.

2.5 DUCT FLEXIBLE CONNECTORS

A. Duct Flexible Connector:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CL WARD & Family Inc.
 - b. DMI Companies
 - c. Duro Dyne Inc.
 - d. DynAir; a Carlisle Company
 - e. Elgen Manufacturing
 - f. Ventfabrics, Inc
 - g. Ward Industries; a brand of Hart & Cooley, LLC
2. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials are to have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
3. Airstream Surfaces: Surfaces in contact with the airstream are to comply with requirements in ASHRAE 62.1.
4. Materials: Flame-retardant or noncombustible fabrics.
5. Coatings and Adhesives: Comply with UL 181, Class 1.
6. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
7. Indoor System, Duct Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - c. Service Temperature: Minus 40 to plus 200 deg F.
8. Outdoor System, Duct Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 24 oz./sq. yd.
 - b. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - c. Service Temperature: Minus 50 to plus 250 deg F.
9. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

- a. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
- b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
- g. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.6 DUCT ACCESSORY HARDWARE

A. Duct Accessory Hardware:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CL WARD & Family Inc.
 - b. DMI Companies
 - c. Duro Dyne Inc.
 - d. DynAir; a Carlisle Company
 - e. Elgen Manufacturing
 - f. United Enertech Corp.
 - g. Ventfabrics, Inc
 - h. Ward Industries; a brand of Hart & Cooley, LLC
2. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
3. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.7 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 1. Galvanized Coating Designation: G90.
 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and bright finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B209/B209M, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

- D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.8 FLEXIBLE DUCTS

- A. Standard: Product is to be UL 181 listed and bearing the UL label.
- B. Flexible Ducts, Insulated - Class 1, Two-Ply Vinyl Film Supported by Helically Wound, Spring-Steel Wire; Fibrous-Glass Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATCO Rubber Products, Inc.
 - b. Flexmaster U.S.A., Inc
 - c. JP Lamborn Co.
 - d. Thermaflex; a Flex-Tek Group company
 - 2. Pressure Rating: 10 inch wg positive and 1.0 inch wg negative.
 - 3. Maximum Air Velocity: 1000 fpm.
 - 4. Temperature Range: Minus 10 to plus 160 deg F.
 - 5. Insulation R-Value: Comply with ASHRAE/IES 90.1.
 - 6. Vapor-Barrier Film: Polyethylene or Aluminized, ASTM E96/E96M.

2.9 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with stainless-steel or zinc-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
- B. Non-Clamp Connectors: Liquid adhesive plus tape.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR DUCT ACCESSORIES, GENERAL

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

- C. Install duct test holes where required for testing and balancing.
- D. Remote Damper Operators: Install per manufacturer's written instructions.

3.2 INSTALLATION OF DAMPERS

- A. Backdraft and Pressure-Relief Dampers: Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- B. Control Dampers: Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- C. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full-system-design static pressure.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Manual Volume Dampers: Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having a duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

3.3 INSTALLATION OF UL-LISTED DAMPERS

- A. Install in accordance with UL listing.

3.4 INSTALLATION OF DUCT-MOUNTED ACCESS DOORS, ACCESS PANELS, AND PRESSURE-RELIEF DOORS

- A. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Upstream from duct filters.
 - 2. At outdoor-air intakes and mixed-air plenums.
 - 3. At drain pans and seals.
 - 4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links are to be pressure-relief access doors and be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

6. At each change in direction and at maximum 50 ft. spacing.
 7. Upstream and downstream from turning vanes.
 8. Upstream or downstream from duct silencers.
 9. For grease ducts, install at locations and spacing as required by NFPA 96.
 10. Control devices requiring inspection.
 11. Elsewhere as indicated.
- B. Install access doors with swing against duct static pressure.
- C. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- D. Duct Access Panel Assemblies: Install in fire-rated duct systems per manufacturer's written instructions.
- E. Label access doors in accordance with Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of each access door.

3.5 INSTALLATION OF DUCT FLEXIBLE CONNECTORS

- A. Install flexible connectors to connect ducts to equipment.
1. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- B. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.6 INSTALLATION OF FLEXIBLE DUCTS

- A. Install flexible ducts in accordance with applicable details in the following publications:
1. ADC's "Flexible Duct Performance & Installation Standards" for flexible ducts.
 2. NAIMA AH116.
 3. SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
 4. SMACNA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install in indoor applications only. Do not install flexible duct in locations where it will be exposed to UV rays.
- C. Where flexible duct is to be installed in locations where it will be exposed to UV rays, install only duct that is specifically made for this use and has been so marked by the

manufacturer.

- D. Connect diffusers and light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- E. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
- F. Installation of Flexible Ducts:
 - 1. Install ducts fully extended.
 - 2. Do not bend ducts across sharp corners.
 - 3. Bends of flexible ducting must not exceed a minimum of one-duct diameter.
 - 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 - 5. Install flexible ducts in a direct line, without sags, twists, or turns.
 - 6. Install in accordance with ADC instructions.
- G. Supporting Flexible Ducts:
 - 1. Support flexible duct at manufacturer's recommended intervals, but at no greater distance than 4 ft. Provide sufficient support so that maximum centerline sag is 1/2 inch per ft. between supports. A connection to rigid duct or equipment may be considered a support joint.
 - 2. Install extra supports at bends placed approximately one-duct diameter from center line of the bend.
 - 3. Ducts may rest on ceiling joists or truss supports. Spacing between supports must not exceed the maximum spacing in accordance with manufacturer's written installation instructions.
 - 4. Vertically installed ducts must be stabilized by support straps at a maximum of 72 inches o.c.

3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Dampers: Operate dampers to verify full range of movement.
 - 2. Duct-Mounted Access Doors, Access Panels, and Pressure Relief Doors: Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
 - 3. UL-Listed Dampers: Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
 - 4. Turning Vanes: Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
 - 5. Remote Damper Operators: Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233400 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fans, centrifugal - backward-inclined blades.
2. Ventilators, centrifugal - roof-mounted downblast.
3. Ventilators, centrifugal - roof-mounted upblast and sidewall mounted.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
2. Rated capacities, furnished specialties, and accessories for each fan.
3. Fans:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound-power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - e. Fan speed controllers.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittals: For vibration isolation, supports, 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. Design Calculations: Calculate requirements for selecting vibration isolators and supports.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans showing fan rooms and fan system layouts, reflected ceiling plans, and other drawings required to illustrate relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Seismic Qualification Data: Certificates, for fans, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Startup service reports.
- D. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fans and ventilators, include the following:
 1. Operation in normal and emergency modes.
 2. Operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective coverage for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 FANS, CENTRIFUGAL - BACKWARD-INCLINED BLADES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Loren Cook Company
 - 2. Greenheck Fan Corporation
- B. Source Limitations: Obtain backward-inclined centrifugal fans from single manufacturer.
- C. Description:
 - 1. Factory-fabricated, -assembled, -tested, and -finished, direct- driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 - 2. Factory-installed and -wired disconnect switch.
- D. Standards: Comply with UL 705.
- E. Accessories:
 - 1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 - 2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
 - 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - 4. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
 - 5. Inlet Screens: Grid screen of same material as housing.
 - 6. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 - 7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 - 8. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
 - 9. Piezometer Ring: Piezometer ring mounted at fan inlet cone for airflow measurement.

2.3 VENTILATORS, CENTRIFUGAL - ROOF-MOUNTED DOWNBLAST

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carnes Company
 - 2. Greenheck Fan Corporation
 - 3. Loren Cook Company
 - 4. PennBarry; division of Air System Components
- B. Source Limitations: Obtain roof-mounted downblast centrifugal ventilators from single manufacturer.
- C. Standards: Comply with UL 705.
- D. Housing: Downblast; removable spun-aluminum dome top and outlet baffle; square, one-piece aluminum base with venturi inlet cone.
- E. Accessories:
 - 1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 - 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - 5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
 - 6. Spark-resistant, all-aluminum wheel construction.
 - 7. Mounting Pedestal: Galvanized steel with removable access panel.
- F. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - a. Roof curb to be provided by fan manufacturer.
 - 2. Overall Height: 12 inches.
 - 3. Sound Curb: Curb with sound-absorbing insulation.
 - 4. Pitch Mounting: Manufacture curb for roof slope.
 - 5. Metal Liner: Galvanized steel.
 - 6. Mounting Pedestal: Galvanized steel with removable access panel.

2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for

HVAC."

- B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.5 SOURCE QUALITY CONTROL

- A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
- B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.
- C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.
- D. Fan Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Install roof-mounted fans on roof curbs or support steel. See Drawings for specific requirements.
 - 2. Unit Support: Install fans level on structural curbs. Coordinate with duct connections. Secure units to structural support with anchor bolts.
 - 3. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Curb Support, Prefabricated: Rail-type wood support provided by fan manufacturer.
- F. Unit Support: Install centrifugal fans level on structural curbs. Coordinate with duct connections. Secure units to structural support with anchor bolts.
- G. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration-isolation devices.

- H. Install units with adequate clearances for service and maintenance.
- I. Label fans in accordance with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Where installing ducts adjacent to fans, allow space for service and maintenance.

3.3 PIPING CONNECTIONS

- A. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2inch high.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.6 STARTUP SERVICE:

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
 - 6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 7. Adjust belt tension.
 - 8. Adjust damper linkages for proper damper operation.
 - 9. Verify lubrication for bearings and other moving parts.
 - 10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 12. Shut unit down and reconnect automatic temperature-control operators.
 - 13. Remove and replace malfunctioning units and retest as specified above.

3.7 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.
- D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and

inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties.
 - 3. Fans and components will be considered defective if they do not pass tests and inspections.
 - 4. Prepare test and inspection reports.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans.

END OF SECTION 233400

SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceiling diffusers - rectangular and square face.

B. Related Requirements:

1. Section 233713.23 "Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
2. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

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 Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.

D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

- 5. Duct access panels.
- B. Source Quality Control Reports: For air diffusers.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS - RECTANGULAR AND SQUARE FACE

- A. Ceiling Diffuser - Rectangular and Square:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company
 - b. Nailor Industries Inc
 - c. Price Industries Limited
 - d. Titus; brand of Johnson Controls International plc, Global Products
 - 2. Description: Square or Rectangular ceiling diffuser with round or rectangular duct collar and a series of curved louvers to provide discharge parallel to ceiling surface. See schedules on the drawings.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers in accordance with ASHRAE 70.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR DIFFUSERS

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Owner's Representative for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Registers - adjustable-blade face.
2. Registers - fixed-blade face.
3. Grilles - adjustable-blade face.
4. Grilles - fixed-blade face.
5. Grilles - linear bar.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
3. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - b. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Actual size of smallest register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Actual size of smallest size register and grille indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS

- A. Registers - Adjustable-Blade Face (as scheduled on drawings.):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company
 - b. Nailor Industries Inc
 - c. Price Industries Limited
 - d. Titus; brand of Johnson Controls International plc, Global Products
 2. Material: Aluminum.
 3. Finish: Baked enamel, color selected by Owner's Representative.
- B. Registers - Fixed-Blade Face (as scheduled on drawings.):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company
 - b. Nailor Industries Inc
 - c. Price Industries Limited
 - d. Titus; brand of Johnson Controls International plc, Global Products
 2. Material: Aluminum.
 3. Finish: Baked enamel, color selected by Owner's Representative.

2.2 GRILLES

- A. Grilles - Adjustable-Blade Face (as scheduled on drawings.):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company
 - b. Nailor Industries Inc
 - c. Price Industries Limited

- d. Titus; brand of Johnson Controls International plc, Global Products
 - 2. Material: Aluminum.
 - 3. Finish: Baked enamel, color selected by Owner's Representative.
- B. Grilles - Fixed-Blade Face (as scheduled on drawings.):
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes Company
 - b. Nailor Industries Inc
 - c. Price Industries Limited
 - d. Titus; brand of Johnson Controls International plc, Global Products
 - 2. Material: Aluminum.
 - 3. Finish: Baked enamel, color selected by Owner's Representative.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate registers and grilles in accordance with ASHRAE 70.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF REGISTERS AND GRILLES

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Owner's Representative for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 233716 - FABRIC AIR-DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabric air-distribution duct and devices.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
- B. Shop Drawings: For fabric air-distribution devices.
 - 1. Include plans, elevations, sections, and suspension and attachment details.
- C. Samples for Initial Selection: Fabric samples for air-distribution devices with factory-applied color finishes.
- D. Samples for Verification: Fabric samples for air-distribution devices, in manufacturer's standard sizes to verify color selected.
- E. Diffuser Schedule: Use same designations indicated on Drawings. Indicate room location, quantity, model number, size, and accessories furnished.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Source quality control reports.

PART 2 - PRODUCTS

2.1 FABRIC AIR-DISTRIBUTION DUCT AND DEVICES

- A. Fabric Air-Distribution Duct and Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DuctSox Corp.
 - b. FabricAir Inc.
- B. Source Limitations: Obtain fabric air duct and distribution devices from a single manufacturer.
- C. Performance Requirements:
 1. Continuous tubular diffuser materials are to be listed and labeled.
 2. Air permeability of fabric is to comply with ASTM D737.
- D. Description:
 1. Fabric: Polyester.
 2. Shape: Round.
 3. Air-Outlet Configuration:
 - a. Periodic nozzles.
 4. Color: Coordinate with Owner's Representative.

PART 3 - EXECUTION

3.1 INSTALLATION OF FABRIC AIR-DISTRIBUTION DUCT AND DEVICES

- A. Drawings indicate general arrangement of ducts, fittings, and accessories. Air-outlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated. Where architectural features or other items conflict with installation, notify Owner's Representative to determine final location.

END OF SECTION 233716

SECTION 237416.11 - PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged, small-capacity, rooftop air-conditioning units.

1.2 DEFINITIONS

- A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

PART 2 - PRODUCTS

- A. Package Rooftop Units will be Owner Furnished – Contractor Installed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Roof Curb: Install on roof structure or concrete base, level and secure, in accordance with NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations

of roof curbs with actual equipment provided.

3.3 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
1. Install ducts to termination at top of roof curb.
 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 4. Install return-air duct continuously through roof structure.

3.4 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Inspect for visible damage to unit casing.
 3. Inspect for visible damage to furnace combustion chamber.
 4. Inspect for visible damage to compressor, coils, and fans.
 5. Inspect internal insulation.
 6. Verify that labels are clearly visible.
 7. Verify that clearances have been provided for servicing.
 8. Verify that controls are connected and operable.
 9. Verify that filters are installed.
 10. Clean all coils and inspect for construction debris.
 11. Connect and purge gas line.
 12. Remove packing from vibration isolators.
 13. Verify lubrication on fan and motor bearings.
 14. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 15. Adjust fan belts to proper alignment and tension.
 16. Start unit in accordance with manufacturer's written instructions.
 - a. Start refrigeration system.

- b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
- 17. Inspect and record performance of interlocks and protective devices; verify sequences of operation.
- 18. Operate unit for an initial period as recommended or required by manufacturer.
- 19. Calibrate thermostats.
- 20. Adjust and inspect high-temperature limits.
- 21. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
- 22. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
- 23. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- 24. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
- 25. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
- 26. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
- 27. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. RTU will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.11

SECTION 237416.13 - PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged, large-capacity, rooftop air-conditioning units.

1.2 DEFINITIONS

- A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

PART 2 - PRODUCTS

- A. Package Rooftop Units will be Owner Furnished – Contractor Installed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Unit Support: Install unit level on structural steel supports. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 PIPING CONNECTIONS

- A. Where installing piping adjacent to RTU, allow space for service and maintenance.
- B. Connect piping to unit mounted on vibration isolators with flexible connectors.
- C. Connect condensate drain pans using, ASTM B88, Type M copper tubing.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.5 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to compressor, coils, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean all coils and inspect for construction debris.
 - 10. Remove packing from vibration isolators.
 - 11. Inspect operation of barometric relief dampers.
 - 12. Verify lubrication on fan and motor bearings.
 - 13. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 14. Adjust fan belts to proper alignment and tension.
 - 15. Start unit in accordance with manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
 - 16. Inspect and record performance of interlocks and protective devices; verify sequences of operation.

17. Operate unit for an initial period as recommended or required by manufacturer.
18. Calibrate thermostats.
19. Adjust and inspect high-temperature limits.
20. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
21. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
22. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
23. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
24. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
25. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. Low-temperature safety operation.
 - b. Filter high-pressure differential alarm.
 - c. Economizer to minimum outdoor-air changeover.
 - d. Smoke and firestat alarms.
26. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.7 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.13

SECTION 237433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dedicated outdoor-air units.

1.2 DEFINITIONS:

- A. ECM: Electronically commutated motor.
- B. IS COP: Integrated Seasonal Coefficient of Performance.
- C. ISMRE: Integrated Seasonal Moisture Removal Efficiency.
- D. MRC: Moisture Removal Capacity.

1.3 ACTION SUBMITTALS

- A. Dedicated Outdoor Air Unit will be Owner Furnished – Contractor Installed.

PART 2 - PRODUCTS

2.1 Dedicated Outdoor Air Unit will be Owner Furnished – Contractor Installed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DEDICATED OUTDOOR-AIR UNITS

- A. Roof Curb: Install on roof structure or concrete base, level and secure, in accordance with NRCA's "The NRCA Roofing Manual: Membrane Roof Systems". Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
- B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- C. Install filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.
- D. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."
- E. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.
- F. Comply with requirements for gas-fired furnace installation in NFPA 54.
- G. Install separate devices furnished by manufacturer and not factory installed.
- H. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to units, allow space for service and maintenance.
- C. Connect piping to units mounted on vibration isolators with flexible connectors.
- D. Duct Connections:
 - 1. Comply with requirements in Section 233113 "Metal Ducts."
 - 2. Drawings indicate the general arrangement of ducts.
 - 3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power

Conductors and Cables."

- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate is to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Inspect units for visible damage to furnace combustion chamber.
 - 3. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:
 - a. Measure gas pressure at manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at furnace discharge.
 - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - 4. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
 - a. High-limit heat exchanger.
 - b. Alarms.
 - 5. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
 - 6. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:
 - a. Cooling coil leaving-air, dry- and wet-bulb temperatures.

- b. Cooling coil entering-air, dry- and wet-bulb temperatures.
 - c. Condenser coil entering-air dry-bulb temperature.
 - d. Condenser coil leaving-air dry-bulb temperature.
- 7. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
- 8. Inspect casing insulation for integrity, moisture content, and adhesion.
- 9. Verify that clearances have been provided for servicing.
- 10. Verify that controls are connected and operable.
- 11. Verify that filters are installed.
- 12. Clean coils and inspect for construction debris.
- 13. Clean furnace flue and inspect for construction debris.
- 14. Inspect operation of power vents.
- 15. Purge gas line.
- 16. Inspect and adjust vibration isolators and seismic restraints.
- 17. Verify bearing lubrication.
- 18. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
- 19. Adjust fan belts to proper alignment and tension.
- 20. Start unit.
- 21. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
- 22. Operate unit for run-in period.
- 23. Calibrate controls.
- 24. Adjust and inspect high-temperature limits.
- 25. Inspect outdoor-air dampers for proper stroke.
- 26. Verify operational sequence of controls.
- 27. Measure and record the following airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Relief-air flow.
 - c. Outdoor-air flow.
- B. After startup, change filters, verify bearing lubrication, and adjust belt tension.
- C. Remove and replace components that do not properly operate, and repeat startup procedures as specified above.
- D. Prepare written report of the results of startup services.

3.7 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.8 CLEANING

- A. After completing system installation; testing, adjusting, and balancing dedicated outdoor-air unit and air-distribution systems; and completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
 - 2. Charge refrigerant coils with refrigerant and test for leaks.
 - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237433

SECTION 260500 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

The Electrical General Requirements are supplementing and applicable to Division 26 Sections and shall apply to all phases of work specified herein, shown on the Drawings, or required to provide a complete installation of electrical systems. Section 26 is sub-divided for convenience only.

A. This Section includes the following:

1. Job Conditions
2. Regulatory Requirements
3. Electrical equipment coordination and installation.
4. Submittals, Operating and Maintenance instructions and As-built drawings.
5. Common electrical installation requirements.
6. Warranty of work.

1.2 JOB CONDITIONS:

- A. SITE INSPECTIONS:** Before submitting proposals, each bidder should visit the site and fully familiarize himself with all job conditions and shall be fully informed as to the extent of his work. No consideration will be given after bid opening date for alleged misunderstanding as to the requirements of work involved in connecting to the utilities or as to requirements of materials to be furnished.
- B. EXISTING CONDITIONS:** All utilities, existing system and conditions shown on the plans as existing are approximate, and the Contractor shall verify before any work is started.
- C. SCHEDULED INTERRUPTIONS:** Planned interruptions of utilities service, to any facility affected by this contract, shall be carefully planned and approved by Architect at least ten (10) days in advance of the requested interruption. The Contractor shall not interrupt services until the Architect has granted specific approval. The request shall indicate services to be affected, date and time of interruption and duration of outage. Request for interruption of service will not be approved until all equipment and materials required for the completion of that particular phase of work are on the job site. The work may have to be scheduled after normal working hours.
- D. ACCIDENTAL INTERRUPTIONS:** All excavation and/or remodeling work required shall be performed with care so as not to interrupt other existing services (water, gas, electrical, sewer, sprinklers, etc.). If accidental utility interruption resulting from work performed by the Contractor occurs, service shall be immediately restored to its original condition without delay, by and at the expense of the Contractor, using skilled workmen of the trade required.
- E. MAINTAINING SERVICE:**
- (1) Any existing service (or operating system) which must be interrupted for any length of time shall be supplied with a temporary service if necessary for continuation of the normal operation of this facility.

- (2) Any existing system or part of an existing system currently in operation shall remain so after all additions or renovations are made and all work is completed.

1.3 REGULATORY REQUIREMENTS:

- A. PERMITS, FEES, AND INSPECTIONS: This Contractor shall secure and pay for all permits, and inspections required on work performed under this section of the Specifications. He shall assume full responsibility for all assessments and taxes necessary for the completion and acceptance of the work.
- B. APPLICABLE STANDARDS AND CODES: The electrical installation shall comply with all applicable building codes; local, state, and federal ordinances; and the National Electrical Code (NFPA 70). In case of a discrepancy among these applicable regulatory codes and ordinances, the most stringent requirement shall govern. The Contractor shall notify the Architect in writing of any such discrepancy. Should the Contractor perform any work that does not comply with the applicable regulatory codes and ordinances he shall bear all cost arising in correcting the deficiencies. Application standards and codes shall include all local ordinances, all state laws, and the applicable requirements of the following: using the editions in legal effect at the time of application for permit.
1. American National Standards Institute - ANSI
 2. National Electrical Manufacturer's Association - NEMA
 3. National Fire Protection Association – NFPA (latest editions)
 4. The Life Safety Code – NFPA 101
 5. The National Fire Alarm Code – NFPA 72
 6. Florida Building Code
 7. Underwriters' Laboratories, Inc. – UL
- C. DRAWINGS AND SPECIFICATIONS: The drawings and these specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both. Omissions from the drawings and specifications of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such work. In any case of discrepancy in the figures or catalog numbers, the matter shall be submitted to the Architect, who shall promptly make a determination in writing. Any adjustment by the Contractor shall be at the Contractor's own risk and expense. Electrical drawings are diagrammatic only. Do not scale these drawings. All equipment shall be installed in accordance with manufacturer's recommendations and any conflicting data shall be verified before bidding.
- D. LETTERS CERTIFYING COMPLIANCE AND REVIEW: These Documents will be revised, as required by any legal authority having jurisdiction and by any serving utility, with no additional cost to the Owner. As soon as practical after bidding, and before any work is commenced, the Contractor shall meet with all legal authorities having jurisdiction, review all materials and details of this project and agree on any required revisions. A letter shall be written to the Architect listing the names, dates, places of such review, the revisions required (at no additional cost). A copy of the letter shall also be sent to the reviewing authority. The Contractor shall also meet with each serving utility and repeat the above procedure. A letter certifying each meeting shall be written also with the information as described above.

The Contractor shall after completion of the work, furnish the Architect a certificate of final inspection and approval from the applicable local inspection department. Make necessary changes to plans and specifications to meet code standards at no additional cost to the Owner.

1.4 COOPERATION:

- A. **INTERFACING WITH OTHER CRAFTS:** It shall be the responsibility of the Contractor to cooperate and coordinate with all other crafts working on this project. This Contractor shall do all cutting, trenching, backfill and structural removals to permit entry of the electrical system components. The General Contractor shall do all patching and finishing. The Architect's representative shall render a decision in writing as to space allotment in congested areas. No claims for "extras" due to such decisions shall be allowed, even though the work has already been installed. When the Contractor submits for approval any item or equipment, he shall determine for himself whether or not it will fit the space provided. If, after installation of any equipment, wiring or other items, it is determined that ample maintenance or passage space has not been provided, then the Contractor shall rearrange this work and/or furnish other equipment even though the equipment installed has been approved. A 1/2" = 1'0" scaled drawing of the main building equipment rooms shall be submitted with the electrical shop drawings showing the proposed location of all equipment in each room. SPACE ALLOCATION IN THESE ROOMS IS CRITICAL. ALSO SUBMIT ELEVATIONS OF EACH MAJOR WALL TO ENSURE CODE REQUIRED CLEARANCES ARE MAINTAINED.
- B. **EQUIPMENT FURNISHED UNDER OTHER SECTIONS:** This Contractor shall furnish and install, complete electrical roughing-in and connections to all equipment furnished under other sections and indicated on the full construction set of drawings. This includes all outlets as shown on mechanical, plumbing, and electrical drawings. All such equipment shall be set in place as work of other sections.
- C. **HEATING AND AIR CONDITIONING:**
1. The Contractor shall furnish all branch circuit wiring to motors and control panels or centers including disconnects, receptacles, switches, and appurtenances to which the system at the units may be connected, to provide a complete system of wiring for power. Control equipment and control circuit wiring is specified in the Mechanical Drawings and Specifications.
 2. Control devices to be included in the branch circuit, except those furnished integral with the equipment, will be delivered by the Heating and Air Conditioning Contractor and installed by the Electrical Contractor.

- 1.5 **WORKMANSHIP:** All work shall be executed in a neat and substantial manner by skilled workman, well qualified, and regularly engaged in the type of work required. Substandard work shall be removed and replaced by the Contractor at no cost to the Owner.

1.6 **APPROVAL OF MATERIALS AND EQUIPMENT:**

- A. **PRIOR-SUBMITTALS:** The Contractor shall base his proposal on the materials specified herein and on the drawings. Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar design. The Architect reserves the sole right to decide the equality of materials proposed for use in lieu of these specified. It shall be the Contractor's responsibility to furnish the information and data sufficient to establish the quality and utility of the items in question, including furnishing of samples if required. If other equipment manufacturers determine that their equipment will fit in the space and meet the recommended clearances, suit all job conditions, equal or exceed the quality of the specified items, then a request may be made in writing to the Architect at least ten (10) working days prior to bid date for permission to be

included in the approved equipment list. All data required for evaluation shall accompany the above letter.

B. SUBMITTALS:

1. Submittals: The Contractor shall submit a list of equipment proposed for installation. He shall submit catalog data and shop drawings on all proposed systems and their components. Where substitutions alter the design or space requirements, the Contractor shall defray all items of cost for the revised design and construction including costs to all allied trades involved. Provide copies of submittals and shop drawings as required by the master contract requirements.
 - a. Submittals Schedule: Submittals shall be submitted within thirty (30) days after the contract is awarded. It is not the responsibility of the Engineer to expedite the review of submittals if the contractor has not adequately prepared the submittals in a time efficient manner. The contractor bears all the responsibility for the added time requirements of resubmittals.
 - b. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1) Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2) Resubmittal Review: Allow 15 days for review of each resubmittal.
 - c. Identification: Place a permanent label or title block on each submittal for identification. Each major section of submittals such as power equipment, lighting equipment, fire alarm, etc., shall be secured in a booklet or stapled with a covering index which lists the following information:
 - 1) Project name and date
 - 2) Name, address, and phone number of General contractor and project manager.
 - 3) Name, address, and phone number of Sub-contractor and project manager.
 - 4) Supplier of equipment with phone number and person responsible for this project.
 - 5) Index of each item covered in submittal and model number.
 - 6) Any deviation from contract documents shall be specifically noted on submittal cover index and specifically identified with highlighting, encircling, or boldly on specific submittal sheet.
 - d. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

Include previous submittal review comments.

 - 1) For each item being resubmitted, include previous review comment and explain how resubmitted item meets the criteria of the previous review comment.

- 2) Only one (1) resubmittal will be accepted. If the resubmittal does not meet the review comments on the initial submittal or the intent of the contract documents the contractor shall provide the original specified equipment or possibly incur costs for additional Engineering effort.
- e. Determinations of Equipment Quality: The final authority on the determination of the quality of any piece of equipment specified, submitted, or resubmitted is solely the Professional Engineer's. As much information as is provided by the Contractor will be used to consider a submitted item to the specified item to determine compliance. The Contractor may provide the actual submitted piece of equipment and the specified item to the Engineer for a table top comparison at his convenience.

2. Electrical and Mechanical/Plumbing/Fire Protection Equipment Coordination's:

The electrical power equipment submittals shall be accompanied by a letter verifying coordination of electrical services for all mechanical, plumbing, and fire protection equipment requiring power. The letter shall follow the format listed below.

To: (General Contractor)

Re: (Project name and location)

We the undersigned subcontractors certify that we have coordinated the electrical requirements for mechanical, plumbing, and fire protection sprinkler equipment as evidenced by the coordination chart listed herein.

Item	Load Full Load Amps	1 Phase or 3 Phase	Number of Electrical Connections	Maximum Overcurrent Protection	Minimum Overcurrent Protection	Breaker Proposed	Circuit Proposed

The above list details all required electrical connections for mechanical equipment.

Signed: _____

For: Mechanical Subcontractor

The above list details all required electrical connections for plumbing equipment.

Signed: _____

For: Plumbing Subcontractor

The above list details all required electrical and fire alarm connections for fire protection equipment.

Signed: _____

For: Fire Protection Sprinkler
Subcontractor

The above list of equipment has been reviewed and the required connections are being provided. (Any exceptions or request for direction shall be listed here)

Signed: _____

For: Electrical Subcontractor

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. PROTECTION: Take necessary precautions to protect all material, equipment, apparatus and work from damage. Failure to do so to the satisfaction of the Architect will be sufficient cause for the rejection of the material, equipment or work in question. Contractor is responsible for the safety and good condition of the materials installed until final acceptance by the owner.
- B. CLEANING: Conduit openings shall be capped or plugged during installation. Fixtures and equipment shall be tightly covered and protected against dirt, moisture, chemical and mechanical injury. At the completion of the work the fixtures, material and equipment shall be thoroughly cleaned and delivered in condition satisfactory to the Architect.

- 1.8 TESTING AND BALANCING: Make tests that may be required by the Owner or the Architect in connection with the operation of the electrical system in the buildings. Balance all single-phase loads connected to all panelboards in the buildings to insure approximate equal divisions of these loads on the main secondary power supply serving the buildings. All tests shall be made in accordance with the latest standards of the IEEE and the NEC. The installation shall be tested for performance, grounds and insulation resistance. A "megger" type instrument shall be used. Contractor shall perform circuit continuity and operational tests on all equipment furnished or connected by Contractor. The tests shall be made in the presence of the Architect or his representative. The Contractor shall notify the Architect at least twenty-four (24) hours in advance of tests. The Contractor shall provide all testing equipment and all costs shall be borne by him. Written reports shall be made of all tests. All faults shall be corrected immediately.

A letter shall be written giving the following:

- A. Measured amps on each phase of each panel.
- B. Resistance to ground of each grounding electrode.
- C. Measured voltage phase to phase and phase to neutral at each panel.
- D. Ground continuity and polarity instrument used.

1.9 OPERATING AND MAINTENANCE INSTRUCTIONS/AS BUILT DRAWINGS:

- A. Four (4) complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Owner. Each set shall be permanently bound and shall have a hard cover. One complete set shall be

furnished at the time that the test procedure is submitted, and remaining sets shall be furnished before the Contract is completed. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2" by 11" with large sheets of Drawings folded in. The instructions shall include information for major pieces of equipment and systems.

- B. Upon completion of the work and at the time designated, the services of one project engineer shall be provided by the Contractor to instruct the representative of the Owner in the operation and maintenance of the systems.
- C. This Contractor shall provide as-built Drawings at the completion of the job. Drawings shall show all significant changes in equipment, wiring, routing, location, etc. All underground conduit routing shall be accurately indicated with locations dimensioned.

- 1.10 GUARANTEE AND SERVICE: Upon completion of all tests and acceptance, the Contractor shall furnish the Owner a written guarantee covering the electrical work done for a period of one (1) year from date of acceptance. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Upon notice from the Architect or the Owner, the Contractor shall, during the guarantee period, rectify and replace any defective material or workmanship and repair any damage caused thereby without additional cost.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.**

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors:** Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation:** Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2

2.2 CONNECTORS AND SPLICES

- A. Description:** Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.**

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- H. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches** of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Firestop specifications within the spec book and Section 26 05 23 "Firestop Systems and Acoustical Wall Sleeves".

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 1. Procedures used.
 2. Results that comply with requirements.
 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 26 05 23 – FIRESTOP SYSTEMS AND ACOUSTICAL WALL SLEEVES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Through penetration firestop systems.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Conduits and sleeves through acoustically sensitive wall.

1.2 PERFORMANCE REQUIREMENTS

- A. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - 3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).
- B. 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.
- C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- D. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Hilti, Inc.
 - 3. Nelson Firestop Products.
 - 4. NUCO Inc.
 - 5. RectorSeal Corporation (The).
 - 6. Specified Technologies Inc.
 - 7. 3M; Fire Protection Products Division.
 - 8. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.3 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Coordinate sleeve selection and application with selection and application of firestopping.

2.4 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Plastic. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 CONDUITS AND SLEEVES THROUGH ACOUSTICALLY SENSITIVE WALLS

Refer to Architectural details for requirements for penetrating acoustically sensitive walls.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Identification: Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the

following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.2 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage an independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Coordinate sleeve selection and application with selection and application of firestopping.
- C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between conduit and sleeve for installing mechanical sleeve seals.

END OF SECTION 26 05 23

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: **Copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, **1/4 inch** in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; **1-5/8 inches** wide and **1/16 inch** thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; **1-5/8 inches** wide and **1/16 inch** thick.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless **compression**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, **sectional type; 3/4 inch by 10 feet.**

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for **No. 8** AWG and smaller, and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so **4 inches (100 mm)** will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from **2 inches (50 mm)** above to **6 inches (150 mm)** below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

- D. Pad-Mounted Transformers and Switches: Install two ground rods around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install copper conductor not less than No. 2 AWG for taps to equipment grounding terminals.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of **five** times the applied force.

1.3 ACTION SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. 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. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. 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** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as **required by** NFPA 70. Minimum rod size shall be **1/4 inch** in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted **or other** support system, sized so capacity can be increased by at least **25** percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with **two-bolt conduit clamps**.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT, 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. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.
 - 6. To Steel: **Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69**
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than **4 inches (100 mm)** larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000-psi**, 28-day compressive-strength concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of **2.0 mils (0.05 mm)**.
- B. Touchup: Comply with requirements in **Section 099113 "Exterior Painting" Section 099123 "Interior Painting"** for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

- A. Product Data:** For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings:** For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:** Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling:** Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC:** Comply with ANSI C80.1 and UL 6.

- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated **IMC**.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: **0.040 inch**, minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797. Fire alarm conduit shall be the color red.
- G. FMC: Comply with UL 1;.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: **Steel or die cast**.
 - b. Type: **Compression**
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of **0.040 inch**, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: **Type EPC-40-PVC**, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Continuous HDPE: Comply with UL 651B.
- F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Fittings for LFNC: Comply with UL 514B.

- I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, **Type 1** unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
- D. Tele-Power Poles:
 1. Material: **Galvanized steel with ivory baked-enamel finish.**

2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy aluminum**, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 1. Material: **Cast metal**.
 2. Type: **Fully adjustable**.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Nonmetallic Floor Boxes: Nonadjustable, **round** or **rectangular**.
 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb** shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing **70 lb**.
 1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **cast aluminum** with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: **4 inches square by 2-1/8 inches deep**
- M. Gangable boxes **are allowed**.
- N. Hinged-Cover Enclosures: Comply with UL 50 and 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.
2. Nonmetallic Enclosures: **Fiberglass**.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: **GRC or IMC**
 2. Concealed Conduit, Aboveground: **GRC or IMC**
 3. Underground Conduit: RNC, **Type EPC-40-PVC**
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFNC**.
 5. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: **EMT**.
 2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
 3. Exposed and Subject to Severe Physical Damage: **IMC**. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: **IMC**.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: **1/2-inch** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use **setscrew, steel** fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F**.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least **6 inches** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches** of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within **12 inches** of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than **1-inch** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum **10-foot** intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of **2 inches** of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to **RNC, Type EPC-40-PVC, or IMC** before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4-inch** trade size and insulated throat metal bushings on **1-1/2-inch** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches** of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum **2-inch** radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed **30 deg F** and that has straight-run length that exceeds **25 feet**.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F** (temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F** temperature change.
 - d. Attics: **135 deg F (75 deg C)** temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least **0.00041 inch per foot of length of straight run per degree F** of temperature change for PVC conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches** of flexible conduit for **recessed and semirecessed luminaires**, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.
- U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
 - 2. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - 3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with **3 inches** of concrete for a minimum of **12 inches** on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of **60 inches** from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

4. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from **1/2-inch** sieve to **No. 4** sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures **1 inch** above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Firestop specifications within the spec book and Section 26 05 23 "Firestop Systems and Acoustical Wall Sleeves".
- B. PROTECTION
- C. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Firestop specifications within the spec book and Section 26 05 23 "Firestop Systems and Acoustical Wall Sleeves".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Advance Products & Systems, Inc.
 - b. Metraflex Company (The).
 - c. Proco Products, Inc.
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 2. Sealant shall have VOC content of g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for **1-inch (25-mm)** annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. **Black letters on an orange field**
 2. Legend: Indicate voltage **and system or service type**.

- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, **0.010 inch** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. **Black letters on an orange field.**
 - 2. Legend: Indicate voltage **and system or service type.**
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; **2 inches** wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, **0.010 inch** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than **3 mils** thick by **1 to 2 inches** wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, **0.010 inch 0.015 inch** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical **and communications** utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,
- C. Tag: **Type I:**
 - 1. Pigmented polyolefin, bright-colored, **continuous-printed on one side with the inscription of the utility**, compounded for direct-burial service.
 - 2. Thickness: **4 mils**.
 - 3. Weight: **18.5 lb/1000 sq. ft.**
 - 4. **3-Inch** Tensile According to ASTM D 882: **30 lbf**, and **2500 psi**.

2.6 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. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. **1/4-inch** grommets in corners for mounting.
 - 3. Nominal size, **7 by 10 inches**
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch** galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. **1/4-inch** grommets in corners for mounting.
 - 3. Nominal size, **10 by 14 inches**.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR **36 INCHES**."

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum **1/16 inch** thick for signs up to **20 sq. inches** and **1/8 inch** thick for larger sizes.
 - 1. Engraved legend with **black letters on white face**.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch**.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch**. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch**. Overlay shall provide a weatherproof and UV-resistant seal for label.

- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be **3/8 inch**.
- C. Stenciled Legend: In nonfading, waterproof, **black** ink or paint. Minimum letter height shall be **1 inch**.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at **50-foot** maximum intervals in straight runs, and at **25-foot** maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at **6 to 8 inches** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench **or concrete envelope** exceeds **16 inches** overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than **30 A**, and **120 V** to ground: Install labels at **30-foot** maximum intervals.

- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Emergency Power.
 2. Power.
 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase **and Voltage Level** Identification, 600 V or Less: Use colors listed below for ungrounded **service, feeder, and branch-circuit** conductors.
 - a. Color shall be factory applied **or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.**
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6 inches (150 mm)** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 - D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
 - E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
 - F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

END OF SECTION 260553

SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment. The study shall take into account the owner furnished generator and ATS equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals **shall** be in digital form.
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
- B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.5 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

- B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Comply with IEEE 1584 and NFPA 70E.
- B. Analytical features of device coordination study computer software program shall have the capability to calculate mandatory features as listed in IEEE 399.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENT

- A. Executive summary.
- B. Study descriptions, purpose, basis and scope.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.

- c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- F. Incident Energy and Flash Protection Boundary Calculations:
 - 1. Arcing fault magnitude.
 - 2. Protective device clearing time.
 - 3. Duration of arc.
 - 4. Arc-flash boundary.
 - 5. Working distance.
 - 6. Incident energy.
 - 7. Hazard risk category.
 - 8. Recommendations for arc-flash energy reduction.
- G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on the device characteristics supplied by device manufacturer.
- D. The extent of the electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 - 2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

- G. The calculations shall include the ac fault-current decay from induction motors and shall apply to low-voltage, three-phase ac systems.
- H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
 - 1. Electric utility's supply termination point.
 - 2. Switchgear.
 - 3. Low-voltage switchgear.
 - 4. Motor-control centers.
 - 5. Standby generators and automatic transfer switches.
 - 6. Branch circuit panelboards.

3.3 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.
- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
 - 2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.
- E. Include low-voltage equipment locations, except 240-V ac and 208-V ac systems fed from transformers less than 125 kVA.
- F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors shall be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond three to five cycles.
- H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
 - 1. When the circuit breaker is in a separate enclosure.
 - 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.4 POWER SYSTEM DATA

- A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
 - 1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
 - 2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate the following input data to support coordination study.
 - 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Obtain electrical power utility impedance at the service.
 - 3. Power sources and ties.
 - 4. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 - 5. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
 - 6. Motor horsepower and NEMA MG 1 code letter designation.
 - 7. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.5 DEMONSTRATION

- A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 260574

SECTION 260923 - DIGITAL-NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. System Software Interfaces.
2. System Backbone and Integration Equipment.
3. Wired Networked Devices.

B. Related Requirements:

1. Div. 26: Section 260500 "Electrical General Requirements" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 262726 "Wiring Devices" for wired switches and dimmers and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. Data Bus: A wired interface used to communicate with connected devices.
- B. Device: A collective term for bus or wireless connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.
- C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.
- D. Group: A set of devices that communicate together.
- E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- F. Scene: Digital light level associated with a preset.
- G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
- B. Preinstallation Coordination Meeting(s): For digital-network lighting controls. Conduct meeting(s) at **Project site** before **rough-in**.

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrators for field tests and inspections.
2. Engage factory-authorized service representative to attend preinstallation conference and review the submittal drawing, sequence of operation, and device installation best practices with Project team.
3. Engage factory-authorized service representative to perform cellular signal strength measurements during site walk through and compare to Project plans to verify the placement of cellular antennas and quantity of lighting control system RF access points.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Bill of Materials necessary to install the networked lighting control system.
2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

B. Shop Drawings:

1. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor Startup/Commissioning Worksheet.

B. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:

1. Hardware and Software Operation Manuals
2. Maintenance service agreement.
3. Software service agreement.

B. Warranty documentation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.
3. Cellular Connectivity: Manufacturer capable of cellular connectivity to a networked lighting control systems available to provide remote support within the continental United States.
4. On-Site Support: Manufacturer capable of providing a 72-hour, on-site response time within the continental United States.
5. Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion, including:
 - a. Remote and on-site emergency response.
 - b. Remote system performance checks.
 - c. Remote diagnostics.
 - d. Replacement parts.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control hardware.
 - b. Faulty operation of lighting control firmware.
 2. Minimum Warranty Period: Five years from date of shipment.

PART 2 - PRODUCTS

2.1 SYSTEM COMPLIANCE

- A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.
- B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.
- C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.
- D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.
- E. System listed as qualified under DesignLights Consortium Networked Lighting Control System Specification v5.0.

F. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture:

1. System architecture based upon the following concepts:

- a. Networkable intelligent lighting control devices.
 - b. Standalone lighting control zones using distributed intelligence.
 - c. Optional system backbone for remote, time-based, and global operation.
2. Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.
3. System capable of interfacing directly with networked luminaires such that either low-voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.
4. Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.
- a. Lighting control zones (wired and wireless) support at least 128 devices per zone.
 - b. Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.
6. Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.
7. System to include one or more system controllers that provide time-based control.
8. System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. System controller supports both low-voltage wired and wireless RF communication within a single controller device.
10. System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.
11. System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:

1. Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable, compliant with CAT5e specifications or higher. Use of mixed types of low-voltage network cables is unacceptable.
2. Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.
3. Pre-terminated, plenum-rated, low-voltage network cabling supplied with hardware.
4. Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).
 - a. The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
5. System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.
6. Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.
7. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:
 - a. Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.
 - b. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
8. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.
9. Wired Networked Wall Station Scene-Control Capabilities:
 - a. Preset Scenes that activate a specific combination of light levels across multiple local and global channels.
 - b. Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.
 - 1) Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.
 - 2) Configurable Parameters:
 - a) Fixture light level.

- b) Occupancy time delay.
 - c) Response to occupancy sensors (including enabling/disabling response).
 - d) Response to daylight sensors (including enabling/disabling response).
 - e) Enabling/disabling wall stations.
 - c. Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.
- C. System Integration Capabilities:
 - 1. Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API including the following system integration capabilities:
 - a. "Write" messages for control of individual devices, including control of relay and dimming output.
 - b. "Write" messages for control of groups of devices through a single command, including control of relay and dimming output of all devices.
 - c. "Read" messages for individual device status information.
 - 1) Available status will vary based on device type and capabilities, which may include relay state, dimming output, power measurement, occupancy sensor status, and photosensor light measurement.
 - d. "Read" messages for group status information for occupancy, relay state, and dimming output.
 - e. Activation of pre-defined system Global Profiles.
 - 2. Activation of Global Profiles from third-party systems via dry contact closure output signals or digital commands via RS-232 or RS-485.
 - 3. Activation of demand response levels from Demand Response Automation Servers (DRAS) via OpenADR 2.0a protocol.
- D. Supported Sequence of Operations:
 - 1. Control Zones:
 - a. Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.
 - b. Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.
 - c. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may

span across multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

2. Wall Station Capabilities:

a. Wall stations support the following capabilities:

- 1) On/Off of a local or global control zone.
- 2) Continuous dimming control of light level of a local or global control zone.

b. Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.

3. Occupancy Sensing Capabilities:

a. Occupancy sensors configurable to control a local or global zone.

b. Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

c. Occupancy sensing sequence of operation modes:

- 1) On/Off Occupancy Sensing.
- 2) Partial-On Occupancy Sensing.
- 3) Partial-Off Occupancy Sensing.
- 4) Vacancy Sensing (Manual-On / Automatic-Off).

d. On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:

- 1) Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
- 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
- 3) System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
- 4) Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
- 5) Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.

e. Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:

- 1) Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.
- 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.

- 3) System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.
 - 4) System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
 - 5) Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.
 - 6) Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.
 - f. Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.
4. Photosensor Sensing Capabilities (Automatic Daylight Sensing):
 - a. Photosensor devices configurable to control a local zone.
 - b. Photosensor-Based Control:
 - 1) Continuous Dimming: Control zone automatically adjusts dimming output in response to photosensor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.
5. Schedule Capabilities:
 - a. System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.
 - b. System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.
 - c. Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.
 - 1) Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.
6. Global Profile Capabilities:
 - a. System capable of automatically modifying the sequence of operation for selected devices in response to any of the following:
 - 1) Time-of-day schedule.
 - 2) Contact closure input state.
 - 3) Manually triggered wired wall station input.
 - 4) RS-232/RS-485 command to wired input device.
 - 5) BACnet input command.
 - b. Global Profile Capabilities:

- 1) Global Profiles stored within and executed from the system controller (via internal timeclock). Dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Global Profile time-of-day schedules capable of recurrence settings including daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control global profile schedules support definition of start date, end date, end after "n" recurrences, or never ending.
 - 3) Daylight savings time adjustments capable of being performed automatically, if desired.
 - 4) Global Profile holiday schedules follow recurrent settings for specific U.S. holiday dates regardless if they always occur on a specific date or are determined by day/week of the month.
 - 5) Global Profiles capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times automatically derived from location information using an astronomical clock.
 - 6) Software management interface capable of displaying a graphic calendar view of profile schedules for each control zone.
 - 7) Global Profiles capable of manual activation directly from system controller, specially programmed wired input devices, scene-capable wired wall stations, and software management interface.
 - 8) Global Profiles selectable to apply to a single device, zone of devices, or customized group of devices.
 - 9) Global Profile Configurable Parameters:
 - a) Fixture light level.
 - b) Occupancy time delay.
 - c) Response to occupancy sensors (including enabling/disabling response).
 - d) Response to daylight sensors (including enabling/disabling response).
 - e) Enabling/disabling of wall stations.
- c. Local and Global Profiles backed up and stored on software's host server such that Profile backup can be applied to a replacement system controller or wired wall station.
7. System supports automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.3 SYSTEMS SOFTWARE INTERFACES

A. Management Interface:

1. Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.
2. Compatible with industry-standard web browser clients.
3. Minimum of 100 unique password-protected user accounts.
4. Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.
5. Capable of restricting access for user accounts to specific devices within the system.
6. All system devices capable of being given user-defined names.
7. Device identification information displayed in the Management interface including:

- a. Model number.
 - b. Model description.
 - c. Serial number or network ID.
 - d. Manufacturing date code.
 - e. Custom label.
 - f. Parent network device.
8. Management interface capable of displaying live status of a networked luminaire or intelligent control device including:
 - a. Luminaire on/off status.
 - b. Dim level.
 - c. Power consumption.
 - d. Device temperature.
 - e. PIR occupancy sensor status.
 - f. Microphonic occupancy sensor status.
 - g. Remaining occupancy time delay.
 - h. Photosensor reading.
 - i. Active Profiles.
9. Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:
 - a. Dimming trim levels.
 - b. Occupancy sensor and photosensor enable/disable.
 - c. Occupancy sensor time delay and light level settings.
 - d. Occupancy sensor response (normal or vacancy).
 - e. Photosensor setpoints and transition time delays.
10. Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.
11. Management interface capable of compiling a printable network inventory report.
12. Management interface capable of compiling a printable report detailing all system profiles.
13. All sensitive information stored encrypted.
14. System software updates available for automatic download and installation via the Internet.

B. System Energy Analysis and Reporting:

1. Intuitive graphical screens to facilitate simple viewing of system energy performance.
2. Energy Scorecard: Summarized display that indicates calculated energy savings in dollars or KWh.
3. Software calculates allocation of energy savings by control measures including occupancy sensors, photosensors, and manual switching.
4. Energy savings data calculated for the system as a whole.
5. Time-scaled graph showing all relay transitions.
6. Time-scaled graph showing zone occupancy time delays.
7. Time-scaled graph showing the total light level.
8. Software capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.
9. Data stored in the database will be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).

C. Visualization and Programming Interfaces:

1. System provides an optional web-based visualization interface that displays a graphical floorplan.
2. Graphical floorplan will offer the following types of system visualization:
 - a. Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:
 - 1) Controls embedded light fixtures.
 - 2) Controls devices not embedded in light fixtures.
 - 3) Daylight sensors.
 - 4) Occupancy sensors.
 - 5) Wall switches and dimmers.
 - 6) Scene controllers.
 - 7) Networked relays.
 - 8) Wired bridges.
 - 9) System Controllers.
 - 10) Wired relay panels.
 - 11) Group outlines.
 - b. Group-Only Option: Master graphic of the entire building, by floor, showing only control groups outlined.
 - c. Pan and zoom commands supported to allow smaller areas to be displayed on a larger scale simply by panning and zooming each floor's master graphic.
 - d. Selecting any control device displays the following as applicable:
 - 1) Device catalog number.
 - 2) Device name and custom label.
 - 3) Device diagnostic information.
 - 4) Link to further information on device including status or current configuration.
3. Programming capabilities through the application will include the following:
 - a. Switch, occupancy sensor, and photosensor zone configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.
 - e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation and copy for scene-capable devices.
 - j. Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.
 - k. Fade rate settings.

D. Smartphone Programming Interface for Wired and Wireless Devices:

1. Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.
2. Application supports configuration of wireless networked control devices.
 - a. Application access granted with valid user name and password.

- b. Access to program information governed by permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.
 - c. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
- 3. Application supports configuration or wired networked control devices.
 - a. Connected device access granted through user-defined passcode at initial install.
 - b. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
- 4. Programming Capabilities:
 - a. Switch, occupancy sensor, and photosensor group configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.
 - e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation.
 - j. Application of custom device labels for individual connected lighting control devices.
 - k. Fade rate settings.

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

- A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECY or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
 - 2. System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.
 - 3. System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.
 - 4. System Controller Functions:
 - a. Time-based control of downstream wired and wireless network devices.
 - b. Linking into an Ethernet network.
 - c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
 - 5. Integral web server to support system controller configuration and diagnostics.
 - a. Web Server Control Interface:

- 1) Display associated devices within the context of a graphical floorplan.
 - 2) Provide control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on floorplan.
 - 3) Control Capabilities:
 - a) Control of individual output devices, including control of relay state and analog dimming level where applicable.
 - b) Control of local lighting control zones, including control of relay state and analog dimming level where applicable.
 - c) Control of global lighting control zones, including control of relay state and analog dimming level where applicable.
 - d) Control of Global Profiles.
 - b. Visualization Interface:
 - 1) Customizable display with the ability to superimpose colored, transparent layers representing real-time property values, including occupancy status, dimming level status, light level status, and online or offline status where applicable.
 - 2) Ad hoc display of trended information via an intuitive values-over-time graph.
 - 3) Report Creation:
 - a) Reports accept and graphically display trended status datasets for creator selected devices or zones of devices.
 - b) Report information displayed over a user-defined interval and date range.
 - c) Reports exportable to a standard CSV format.
6. Graphical touch screen to support configuration and diagnostics.
 7. Minimum of three RJ-45 networked lighting control ports for connection to any of the following:
 - a. Graphical touch screen.
 - b. Wired communication bridges.
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port).
 8. Device will automatically detect all network-connected devices.
 9. Capable of managing and operating a minimum of 750 networked devices (wired or wireless) per system controller.
 10. Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.
 11. Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.
 - a. BACnet MS/TP Connection Speed: 9600 to 115200 baud rate.
 - b. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
 12. Integral FIPS 140-2, Level 1 cryptographic module.
 13. Supports RESTful API for control of BACnet objects, user management, date and time, and file management.
 14. NEMA 1 enclosure with Class 1 and Class 2 separation.

- a. Power Supply Voltage: **120 to 277 V(ac)**.
- 15. Automatic algorithm to eliminate redundant, wireless networked paths to streamline communication between the system controller and end devices.
- 16. System Controller Security Provisions:
 - a. Disallow the use of default passwords and require passwords to be updated prior to use.
 - b. Support user role-based access, such as administrator, user, and viewer.
 - c. Signed firmware to ensure that unmodified, authentic software is always installed.
 - d. IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.
 - e. Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.
 - f. Valid cybersecurity listing through a third party.
- 17. Cellular Remote Access: Cellular router and modem for remote access.
 - a. Router supports remote access to at least five system controllers on its local area network or network subnet.
 - b. Remote access capable of device setting updates, schedule updates, system performance optimization, and diagnostics.
 - c. Remote access enabled through outbound communication from router to an outside source. Solutions that begin communication via inbound requests for network access are unacceptable.
 - d. Router supports outbound communication to manufacturer-hosted portal using TLS1.2 or greater in-transit encryption over a cellular or Ethernet connection.
 - e. Router with integral firewall to prevent unauthorized access to devices connected to its local area network port.
 - f. Router includes cellular SIM capable of connection to AT&T, T-Mobile, Sprint, US Cellular, Alaska Wireless, Telefonica, Tellus, Bell, or Sasktel networks where carrier service is available.
 - g. Outbound communication from the router limited to whitelisted endpoints. Devices that allow unrestricted communication are unacceptable.
 - h. Outbound communication from router includes only lighting control system information.

2.5 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; **nPODM** or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
- 2. Mounting: Suitable for installation in single-gang switch box.
- 3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
- 4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- 5. Devices with mechanical push buttons provide tactile and LED user feedback.

6. Devices with mechanical push buttons manufactured with custom button labeling.
7. Wall switch and dimmer options:
 - a. Number of control zones: **as required**.
 - b. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
 - c. Color: **White**.
8. Scene Controller Options:
 - a. Number of Scenes: **as required**.
 - b. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) Preset Level Scene Type.
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
 - 5) Reprogramming of other devices within daisy-chained zone to implement user-selected lighting scene including manual start/stop from the scene controller, or optionally programmed automatic stop after a user-selectable duration between five minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by device's upstream controller to implement a selected lighting profile across multiple zones including manual start/stop from the scene controller, or optionally programmed automatic stop after a user selectable duration between five minutes and 12 hours.
 - c. Color: **Ivory**.

B. Networked Graphic Wall Stations:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPOD TOUCH or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
2. Mounting: Suitable for installation in single-gang switch box.
3. Integral 3.5-inch (88 mm) capacitive full-color touch screen.
4. Power via polarity insensitive Class 2 low-voltage 15 to 24V (dc) power supply.
5. Device enables mobile application control of control zones and scenes through Bluetooth.
6. Communication over standard low-voltage network cabling with RJ-45 connectors.
7. User-customizable screen saver utilizing uploaded image file in common file format including jpg, png, gif, bmp, or tif.
8. Capable of configuration of all switches, dimmers, control zones, and lighting preset scenes via password-protected setup screens.
9. Graphic Wall Station Options:
 - a. Number of Control Zones: Up to 16.
 - b. Number of Scenes: Up to 16.

- c. Profile Scene Duration: User configurable from five minutes to 12 hours.
- d. Color: **White**.

C. Digital Time Clock:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nDTC or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
2. Controls a linear bus of lighting devices supplying all time functions without connection to a system controller.
 - a. Programming of the linear bus of lighting devices must not require additional hardware, including computers, specialized dongles, or other connection devices.
 - b. Programming of the linear bus exclusively done through the touch-screen interface.
3. Capable of up to 32 schedules. Each schedule consists of one set of On and Off times per day for each day of the week and for each of two holiday lists. Schedules assignable to any individual relay or group of relays.
4. Operates from non-volatile memory so that all system programming is retained indefinitely.
5. Mounted inside a relay panel to eliminate the necessity for additional enclosures for complete installation.
6. Capacitive **3.5-inch (88 mm)**, full-color touch screen.

D. Wired Networked Digital Key Switches:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPODA KEY **MNTN** or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
2. Mounting: Suitable for installation in single-gang switch box.
3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
5. LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.
6. Digital Key Switch Options:
 - a. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) Preset Level Scene Type.
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
 - 5) User-programmed local lighting scene run within a daisy-chained group including manual start/stop from the switch, or optionally

programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.

- 6) User-programmed global lighting profile run by an upstream controller across multiple groups including manual start/stop from the switch, or optionally programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.

b. Color: **White**.

E. Wired Networked Auxiliary Input / Output (I/O) Devices:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
2. Plenum rated.
3. Mounting: **inline wired**.
4. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
5. Auxiliary Input/Output Devices Options:
 - a. Contact closure or pull-high input.
 - 1) Input programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input.
 - 1) Input supports zero to 10 V dimming output control from a dimmer switch.
 - 2) Input programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input.
 - 1) Input supports activation of up to four local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - 2) Provides relay and dimming level status to external device (e.g. Touchscreen) when polled.
 - d. 0-10V dimming control output, capable of sinking up to 20mA.
 - 1) Output programmable to support all standard sequence of operations supported by system.
 - e. Digital control output via eidoLED LEDcode communication.
 - 1) Output programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

F. Wired Networked DMX Interface Stations:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPWDMX or comparable product by one of the following:
 - a. ETC.
 - b. Lutron.
 - c. <Insert manufacturer's name>.
2. Description: Multi-protocol, bidirectional DMX512 playback (snapshot) and lighting control gateway.
 - a. Capable of control of networked luminaire or all normal power lighting load types.
 - b. Capable of control of DMX lighting through:
 - 1) DMX input for snapshot capture of lighting presets.
 - 2) Live control of intensity, hue, and saturation of configured DMX Zones from connected stations.
 - c. Integral LED indicators for power, network traffic, processor health, identify, DMX port configuration and status.
 - d. Support recall of up to 16 (total):
 - 1) Prerecorded scenes/snapshots for playback.
 - 2) DMX zones.
 - e. Capable of preset playback as activated by any connected control station.
 - f. Capable of DMX pass-through for real-time output of incoming DMX levels.
 - g. Support four universes of ANSI E1.31 sACN-Streaming ACN (sACN), including priorities, for snapshot capture and recall.
 - h. Support ANSI E1.20 RDM with PC-based software.
 - i. Act as an ANSI E1.33 RDMnet controller.
3. General Requirements:
 - a. Operating Voltages:
 - 1) PoE Class 2 Device.
 - 2) 24 V(dc) (not used if using PoE), 7 W maximum power consumption.
 - b. Operating Temperature: **Minus 32 to plus 113 deg F (0 to 45 deg C).**
 - c. DIN-Rail Mounted on DIN 43880 (35/7.5) rail.
 - d. NEMA Type 1 enclosure.
 - 1) Enclosure Size: **10 inches (260 mm)** wide by **13 inches (330 mm)** high by **4.5 inches (114 mm)** deep.
4. Features:
 - a. Lighting control ports supports:
 - 1) Communication through lighting control (RJ-45) ports that supply 40 mA of power to each device via standard Category 5e low-voltage network cabling.
 - 2) Detection of valid communication and blinking of a unique LED pattern to visually indicate a potential wiring issue.
 - b. DMX Ports:

- 1) Comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
 - 2) Configurable as Input or Outputs.
 - 3) Support ANSI E1.31 sACN.
 - 4) Support Pathway Secure Streaming ACN (ssACN).
 - 5) Comply with California Title 1.81.26.
 - 6) Comply with ANSI E1.20 RDM.
 - 7) Capable of withstanding fault voltages of up to 250 V(ac) without damage.
- c. Dry contact closure input to connect with external control systems to control a lighting control zone or scene.
- d. Ethernet Ports:
- 1) Support IEEE 802.3af Power-over-Ethernet in absence of 24 V(dc).
 - 2) Support auto-negotiated 10/100MB connections speeds.
 - 3) Support IEEE 802.1AB Link Layer Discovery Protocol.
- e. Test Functions:
- 1) Operate without need of a configuration PC to check local wiring.
 - 2) Test connectivity with DMX lights and networked luminaire or all normal power lighting load types.
- f. Complies with the following:
- 1) RoHS 2011/65/EU + A1 2015/863.
 - 2) FCC.
- G. Wired Networked Occupancy and Photosensors:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; **nCM** or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
 2. Detect the presence of human activity within space and fully control the on/off function of lights.
 3. Utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.
 4. Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).
 5. Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.
 6. All sensing technologies are acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.

7. Ceiling, fixture, recessed, and corner mounted sensors available, with multiple lens options available customized for specific applications.
8. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
9. All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
10. Sensor programming parameter available and configurable remotely from the software and locally via the device push button.
11. Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only.
12. Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.
13. Photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
14. Photosensor provide one on/off set-point and include a dead band to prevent the artificial light from cycling. Delay incorporated into the photosensor to prevent rapid response to passing clouds.
15. Photosensor and dimming sensor's set-point and dead band automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set-point may be manually entered or modified.
16. Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
17. Dual zone option available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. The secondary daylight zone capable of being controlled as an "offset" from the primary zone.

H. Wired Networked Wall Switch Sensors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; **nWSX LV** or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
2. Mounting: Suitable for installation in single-gang switch box.
3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push buttons provide tactile and LED user feedback.
6. Wall Switch Sensor Options:
 - a. User Input Control Types: **On/Off/Dimming**.
 - b. Occupancy Sensing Technology: **Dual technology acoustic**.
 - c. Daylight Sensing Option: Inhibit Photosensor.
 - d. Color: **White**.

I. Wired Networked Embedded Fixture Sensors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nES or comparable product by one of the following:

- a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
 2. Network system sensors with occupancy sensors and/or dimming photosensors that can be embedded into luminaire such that only the lens shows on luminaire face.
 3. Occupancy sensor detection pattern suitable for **7.5 to 20-ft. (2.2 to 6-m)** mounting heights.
 4. Embedded Sensor Options:
 - a. Occupancy Sensing technology: **Dual technology acoustic.**
 - b. Sensing Option: **Combination Occupancy/Daylight sensor.**
- J. Wired Networked Power Packs:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
 2. Plenum rated.
 3. Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
 4. Supply Voltage: **120 to 277 V(ac).**
 5. Relay Output: Class 1 relay rated for 16 A at **277 V(ac)** and 1/2 HP at 120 V(ac).
 6. Dimming Output: 0-10 VDC Dimming output.
 7. Sink Current: 100 mA at 0-10 V(dc).
 8. Mounting: Integral **1/2-inch (16-mm)** chase nipple. Plastic clips into junction box are unacceptable.
- K. Wired Networked Relay and Dimming Panel:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; ARP or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper
 2. Outputs: **16** Individual relays per panel, with an equal number of individual 0-10 V(dc) dimming outputs.
 3. Field Configurable Relays (FCR):
 - a. Field configurable to operate in single-, double-, or triple-pole relay groupings.
 - b. Field configurable to operate as normally closed or normally open.
 - c. Provides visual status of current state and manual override control of each relay.
 - d. Minimum Relay Contact Ratings:
 - 1) 40 A at 120-480 V(ac) Ballast.
 - 2) 16 A at 120-277 V(ac) Electronic.
 - 3) 20 A at 120-277 V(ac) Tungsten.
 - 4) 20 A at 48V (dc) Resistive.
 - 5) 2 HP at 120 V(ac).

- 6) 3 HP at 240-277 V(ac).
- 7) 65kA SCCR at 480 V(ac).
4. Dimming Output Rating: Minimum of 100 mA sink current per dimming output.
5. Relay and dimming outputs individually programmable.
6. Listing: UL 924 for control of emergency lighting circuits.
7. Power Supply: Integrated **120-277 V(ac)** supply.
8. Low-Voltage Sensor Input:
 - a. Configurable to support any of the following input types:
 - 1) Indoor Photosensor.
 - 2) Outdoor Photosensor.
 - 3) Occupancy Sensor.
 - 4) Contact Closure.
 - b. Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.
 - c. Sensor input supports all standard sequence of operations.
9. Integrated Digital Time Clock for local schedule control.
10. Contact Closure Input: One for each group of eight output relays that acts as a panel override to activate the normally configured state of all associated relays (i.e., normally open or normally closed).
11. Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.
12. Enclosure:
 - a. Enclosure Rating: NEMA 1.
 - b. Mounting: **Surface** mounted.
 - c. Cover: **Hinged cover with keyed lock.**
- L. Wired Networked Bluetooth Low-Energy Programming Device:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO BT or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
 2. Plenum rated, inline wired, and screw mountable.
 3. Communication and low-voltage power delivered to device via standard low-voltage network cabling with RJ-45 connectors.
 4. Bluetooth communication allows connection from smartphone application for programming device settings within the local daisy-chain zone.
 5. Device provides visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.
- M. Wired Networked Communication Bridge:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nBRG or comparable product by one of the following:

- a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - c. Wattstopper.
2. Suitable for surface mount to a standard 4 by 4-inch (100 by 100 mm) square junction box.
 3. Communication Ports: Eight RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
 4. Capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.
 5. Power Input: Class 2 low-voltage supplied locally via a directly wired power supply.
 6. Wired Bridge capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. Architecture enables loss of power to a particular area to be less impactful on network lighting control system.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 27 low voltage cabling specifications. Minimum conduit size is 1/2 inch (13 mm).
 1. Comply with requirements for cable trays specified in Section 270536 "Cable Trays for Communications Systems."
 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Identify all controls with device address.
- D. Label each device cable within 6 inch (152 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 1. Test continuity of each circuit.

- B. Field tests and inspections must be witnessed by **authorities having jurisdiction**.
- C. Tests and Inspections: **Engage a factory-authorized service representative to perform** test inspections.
 - 1. Test each zone using local and remote control hardware.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
- D. Nonconforming Work:
 - 1. Lighting controls will be considered defective if they do not pass tests and inspections.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Field Test Reports: **Engage a factory-authorized service representative to prepare** field test reports.
 - 1. Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
 - 2. Include list of all points created from actual tests of all addressed control points for lamps, ballasts, manual controls, and sensors.

3.4 REMOTE ACCESS

- A. Digital network lighting control system capable of remote access by manufacturer with the following features:
 - 1. System diagnostics including detection of fault condition in hardware or connected devices.
 - 2. Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.
 - 3. Browser-based interface to verify system functionality.
 - 4. On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.
 - 5. Owner training on the digital network lighting control system available remotely.
- B. Remote access system fully functional over commercial cellular connection or Internet-connected ethernet network.
- C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

- A. **Engage a factory-authorized service representative to perform** startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's published instructions.
 - 2. Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.

3. Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.
4. Program network devices to meet required sequence of operations.
5. Program and verify all sequence of operations.
6. Create backup of system programming.
7. Assist in installation of system software on customer-provided workstation or server.
8. Verify bidirectional communication of manufacturer-provided cellular router with manufacturer-managed remote access portal.

- B. Commissioning Walkthrough: **Engage factory-authorized service representative to collaborate with third-party commissioning agent** to demonstrate lighting control system functionality and verify the system meets the specified Project requirements.

3.6 CLOSEOUT ACTIVITIES

- A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.
- B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

- A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

- A. Engage a factory-authorized service representative to perform on-site system adjustments.
1. On-Site Occupancy Adjustments: When requested within 3 months from date of Substantial Completion, provide on-site settings adjustments to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
 2. Prepare and submit report after each visit that details activities performed.
- B. Engage a factory-authorized service representative to perform remote system adjustments.
1. Remote Occupancy Adjustments: When requested within 3 months from date of Substantial Completion and project registration with lighting control system manufacturer, provide remote settings adjustments to suit actual occupied conditions. Provide up to two sessions to Project during other-than-normal occupancy hours for this purpose.
 - a. System to include manufacturer-provided cellular communication hardware and connection to the system for a minimum of 3 months after substantial completion

to allow for factory representative assistance with settings adjustments and system sustainment.

- b. For the remaining duration of the maintenance term, or in the event cellular connectivity is not available, manufacturer assistance must be available through an Owner-provided, Internet-connected network.

2. Prepare and submit report after each session that details activities performed.

C. Maintenance Service Agreement:

1. Beginning at Substantial Completion, verify that maintenance service agreement includes 12 months' full maintenance by manufacturer's authorized service representative.
2. Include **quarterly and** preventive maintenance.
3. Preventative maintenance to include:
 - a. System diagnostic reports.
 - b. System performance checks.
 - c. Device firmware updates.
 - d. Programming adjustment as required for proper lighting system operation.
 - e. Expedited factory direct warranty processing, replacement, and programming of defective components.
4. Verify that parts and supplies are manufacturer's authorized replacement parts and supplies.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 ACTION 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.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Panelboard schedules for installation in panelboards.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: **Flush- and surface-**mounted cabinets.
1. Rated for environmental conditions at installed location.
- a. Indoor Dry and Clean Locations: NEMA 250, **Type 1**
- b. Outdoor Locations: NEMA 250, **Type 3R**.
- c. Other Wet or Damp Indoor Locations: NEMA 250, **Type 3R**
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 bottom**.
- C. Conductor Connectors: Suitable for use with conductor material and sizes.
- D. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD **Type 1**

2.3 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- C. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: **Bolt-on** circuit breakers.
- D. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- E. Branch Overcurrent Protective Devices: Fused switches.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.
- C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- D. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with **interrupting capacity** to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and $I^2 t$ response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to **NEMA PB 1.1**.
- B. Mount top of trim **74 inches** above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four **1-inch** empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four **1-inch** empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:** Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, **feed**-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, Catalog numbers in lists below are for 20-A devices; revise catalog numbers to require other configurations and ratings.

2.6 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable **slider**; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: **Smooth, high-impact thermoplastic**

2.8 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: **As selected by** unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **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 under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **indicated** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Lugs: Suitable for number, size, and conductor material.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged engine-generator sets for emergency power supply.
- B. Related Requirements:
 - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

PART 2 - PRODUCTS

The generator shall be owner furnished and contractor installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110. The generator shall be installed per the manufacturer's requirements.
- B. Equipment Mounting:
 - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Cast-in-Place Concrete specifications.
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
 - 3. Engage a structural engineer to design the foundations and to assist with the foundation construction.
- C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.
- D. Install packaged engine-generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure enclosure to anchor bolts installed in concrete bases.
- E. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
 - 1. Install flexible connectors and steel piping materials.

2. Insulate muffler/silencer and exhaust system components.
 3. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) clearance from combustibles.
- F. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
- G. Copper and galvanized steel shall not be used in the fuel-oil piping system.
- H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.2 CONNECTIONS

- A. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.
- B. Connect engine exhaust pipe to engine with flexible connector.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.
- E. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.3 IDENTIFICATION

- A. Identify system components according to Section 260553 "Identification for Electrical Systems."
- B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection
 - 1) Compare equipment nameplate data with drawings and specifications.

- 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify the unit is clean.
 - b. Electrical and Mechanical Tests
 - 1) Perform insulation-resistance tests in accordance with IEEE 43.
 - a) Machines larger than 200 horsepower (150 kilowatts). Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 horsepower (150 kilowatts) or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
 - 5) Conduct performance test in accordance with NFPA 110.
 - 6) Verify correct functioning of the governor and regulator.
 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 7. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes automatic transfer switches (ATS) rated 600 V and less.

PART 2 - PRODUCTS

ATS Equipment shall be owner furnished and contractor installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- B. Identify components according to Section 260553 "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.

END OF SECTION 263600

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

- C. Comply with UL 1449.
- D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

- A. SPDs: Comply with UL 1449, **Type 2**.
 - 1. SPDs with the following features and accessories:
 - a. Integral disconnect switch.
 - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - c. Indicator light display for protection status.
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than **200 kA**. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- C. Protection modes and UL 1449 VPR for grounded wye circuits with **480Y/277V and 208Y/120 V**, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: **700 V for 208Y/120 V, 1200 V for 480Y/277V.**
 - 2. Line to Ground: **1200 V for 208Y/120 V, 1200 V for 480Y/277V.**
 - 3. Line to Line: **1000 V for 208Y/120 V, 2000 V for 480Y/277V.**
- D. SCCR: Equal or exceed **200 kA**.
- E. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449, **Type 2**.
 - 1. Include LED indicator lights for power and protection status.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than **100 kA**. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- C. Protection modes and UL 1449 VPR for grounded wye circuits with **208Y/120 V**, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: **700 V for 208Y/120 V, 1200 V for 480Y/277V.**
 - 2. Line to Ground: **700 V for 208Y/120 V, 1200 V for 480Y/277V.**
 - 3. Neutral to Ground: **700 V for 208Y/120 V, 1200 V for 480Y/277V.**
 - 4. Line to Line: **1200 V for 208Y/120 V, 2000 V for 480Y/277V**
- D. SCCR: Equal or exceed **100 kA**.
- E. Inominal Rating: **10 kA**.

2.4 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.
- B. Outdoor Enclosures: NEMA 250, **Type 3R**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 DEMONSTRATION

- A. **Train** Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Lowbay.
4. Recessed linear.
5. Strip light.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.
9. Suspended, nonlinear.
10. Materials.
11. Finishes.
12. Luminaire support.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

- C. Product Schedule: For luminaires and lamps.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Product Certificates: For each type of luminaire.
- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Standards:
 1. ENERGY STAR certified.
 2. California Title 24 compliant.
 3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
 4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
 5. UL Listing: Listed for damp location.
 6. Recessed luminaires shall comply with NEMA LE 4.
- C. CRI of minimum 80. CCT of 4100 K.
- D. Rated lamp life of 50,000 hours to L70.

- E. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage: 277 V ac.
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- H. Housings:
 - 1. Extruded-aluminum housing and heat sink.

2.2 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit maintenance without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.
- C. Diffusers:
 - 1. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear anodized powder-coat finish.

2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
 - 2. Ceiling mount with four-point pendant mount with [5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
 - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod wire support for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.2 DEFINITIONS

- A.** CCT: Correlated color temperature.
- B.** CRI: Color Rendering Index.
- C.** Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D.** Fixture: See "Luminaire" Paragraph.
- E.** Lumen: Measured output of lamp and luminaire, or both.
- F.** Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A.** Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.
- B.** Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A.** Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:
- B.** Product Certificates: For each type of luminaire.

- C. Seismic Qualification Data: Certificates, for luminaires, accessories, and components, from manufacturer.
- D. Sample Warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for recessed luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

- a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet (1000 m).
 4. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
1. Emergency Connection: Operate one fluorescent or LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 3. Nightlight Connection: Operate lamp in a remote fixture continuously.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type.
 6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the ballast manufacturer, whichever is less.
 7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires:
 1. Emergency Luminaires: as indicated on Drawings.

- C. Emergency Lighting Unit:
 - 1. Emergency Lighting Unit: as indicated on Drawings.
 - 2. Operating at nominal voltage of 277 V ac.
 - 3. Wall with universal junction box adaptor.
 - 4. UV stable thermoplastic housing, rated for damp locations.
 - 5. Two LED lamp heads.
 - 6. Internal emergency power unit.
 - 7. External emergency power unit.

2.3 EXIT SIGNS

- A. Internally Lighted Signs:
 - 1. Operating at nominal voltage of 277 V ac.
 - 2. Lamps for AC Operation: Fluorescent, two for each fixture; 20,000 hours of rated lamp life.
 - 3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 - 4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers:
 - 1. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Conduit: Electrical metallic tubing, minimum 1/2 inch (21 mm) in diameter.

2.5 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach fixtures directly to gypsum board.
- F. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of fixture oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
- H. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

- C. Prepare test and inspection reports.

END OF SECTION 265219

SECTION 266000 - INTERIOR ELECTRONIC SCOREBOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section 260519 Low Voltage Electrical Distribution - Interior, electronic, multi-sport scoreboards including control center, and other accessories for complete functional installation.
 - 1. Section 260519 Low Voltage Electrical Distribution

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- B. National Electrical Code.
- C. Federal Communications Commission, Part 15 Rules & Regulations.
- D. UL and C-UL Standard for Electric Signs

1.3 SUBMITTALS

- A. Provide in accordance with Submittal Procedures:
 - 1. To minimize the environmental impact of multiple paper copies, product installation prints, instructions and diagrams of manufacturer will be submitted in a paperless fashion. The end user shall receive all pertinent hard-copy documentation at delivery.
 - 2. Product data for scoreboards, controls, and accessories shall include descriptions of control functions etc.
 - 3. Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage. (Paperless when applicable).
 - 4. Copy of guarantee required by Paragraph 1.5 for review by Architect. (Paperless when applicable).
 - 5. Manufacturer's installation instructions. (Paperless when applicable).
 - 6. Finish Samples.

1.4 QUALITY ASSURANCE

- A. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
- B. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum successful world-wide experience.
- C. Scoreboards and other electrical components shall be certified for use in United States and Canada by Underwriter Laboratories, (UL), Inc. and shall bear either UL or C-UL label only.
- D. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

1.5 GUARANTEE

- A. Provide under provisions of Section 01 78 00 - Closeout Submittals: Guarantee to cover defects in materials and workmanship.
 - 1. Scoreboards, scoring tables, marquees, message centers, video boards* and Stadium Pro loudspeaker enclosures are guaranteed for a period of five (5) years from the date

of invoice against defects in workmanship or materials.

**Video Board exclusions include 8815, 8825, 8835, 8845.

2. Wireless components, portable scoreboards and solar power kit carry a two (2) year guarantee from date of invoice. Hand-held controls and switches carry a one (1) year guarantee from date of invoice. The Stadium Pro loudspeaker front printed scrim is guaranteed for one (1) year from the date of invoice. Video Board Models 8815, 8825, 8835, and 8845 are guaranteed for one (1) year from date of invoice, unless additional years of warranty is purchased. For products supplied by third-party suppliers (i.e. cameras, computers, computer monitors, radar guns, loudspeakers, amplifiers and associated electronics), Purchaser agrees to accept the manufacturer's warranty, if any, in lieu of any warranty by Nevco.
3. Lifetime telephone support.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nevco Inc, 301 East Harris Avenue, Greenville, Illinois 62246; 800-851-4040; www.nevco.com.
- B. Requests to use equivalent products of other manufacturers shall be submitted for review and approval.

2.2 MATERIALS

- A. Aluminum face and perimeter frame: Fabricated from [0.050] [inch] [1.3] [mm] minimum thickness, ASTM B221 aluminum sheet.
- B. Finish: Acrylic polyurethane paint. Color as selected by Architect from manufacturer's standard range. [Color to be [No. 202 – Tan Semi-Gloss] [No. 188 - Electronic Blue Semi-Gloss] [No. 199 – Maroon Semi-Gloss] [No. 187 - Forest Green Semi-Gloss] [No. 183 – Jet Black Semi-Gloss] [No. 194 – Gray Semi-Gloss] [No. 192 – Yellow Semi-Gloss] [No. 191 – Orange Semi-Gloss] [No. 186 – Red Semi-Gloss] [No. 190 – Purple Semi-Gloss] [No. 196 – Teal Semi-Gloss] [No. 197 - Midnight Blue Semi-Gloss] [No. 184 - Royal Blue Semi-Gloss] [No. 185 - Navy Blue Semi-Gloss] [No. 193 - Kelly Green Semi-Gloss] as provided by Nevco, Inc..] **Final colors to be selected by the owner during the shop drawing submittal phase.**
- B. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.
- D. Provide fiber optic communication interface to reduce threat of damage from electrical storms.
- E. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
- F. Provide location specific universal power cord with plug for world-wide installation.
- G. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable, 1/4 inch diameter.
- H. Junction boxes where required: Sheet metal box and cover, 4-1/2 x 2-1/8 x 2-1/8 inches min. complying with NEMA standards.

2.3 SCOREBOARDS

- A. Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, changeable captions, LED displays for time, scores, period, number of player

fouling with personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows; Model 2750-NL (base) as manufactured by Nevco Inc. Rear-lit (RL) caption plates or Electronic Team Names (ETN) are optional and scoreboard shall be capable of in-the-field retrofit. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.

1. Size: 8 feet long x 6 feet high x 8 inches deep.
2. Approximate hanging weight: 130 pounds.
3. Captions:
 - a. 6 inches high:
 - 1) Basic: "Home", "Guests", and "period".
 - 2) Basketball: "fouls" and "player".
 - 3) Volleyball: "won" and "game".
 - 4) Wrestling: "match" and "weight".
4. LED displays:
 - b. Timing: Super Bright Red or White 13 inches high digits with lit colon.
 - c. Team scores: Super Bright Amber or White 13 inches high digits.
 - d. Period: Super Bright Amber or White 9 inches high digits.
 - e. Player number with personal fouls, game, and weight: Super Bright Red or White 9 inches high digits.
 - f. Team fouls, games won, and match: Super Bright Amber or White 9 inches high digits.
 - g. Next possession: Super Bright Amber or White arrow for each team.
 - h. Include bonus and double bonus in the form of a 4 inch Super Bright Red or White LED "B".
5. Rear-lit captions (when specified) shall require zero maintenance.
6. Provide Advertising /Team logo area 3 each, 12" x 12" minimum.
7. Suspension mounting attachments will be included.
8. Power requirement: All options included: 158 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.

2.4 ACCESSORIES/OPTIONS

- A. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware, and other accessories as required for installation are to be provided by others.
- B. Electronic Team Names: "HOME" and "GUEST" caption plates to be replaced with programmable Electronic Team Names as manufactured by Nevco Inc.
 1. Specify changeable team names. (ETN) Shall not require controller upgrade, use of additional accessories or computer.
 2. Specify (R)ed or (A)mber ETN LED's (Example: 27xx ETN-R)
- C. Provide rear-lit caption plate option. Specify (RL). (Model Example: 27xx-RL)
- D. Provide for optional Team Name in place of "HOME" if NL/RL is selected.
- E. Additional accessories include but are not limited to; please specify quantity required.
 1. Nevco Inc Shot Clocks / End of Period (EOP) system.
 2. Nevco Inc Stats Panels
 3. Protective Nets/Screens.
 4. Nevco Inc "A", "AD", or "ADL" signs including Artwork with unlimited amount of color.
 5. Nevco Inc Locker Room Clocks.
 6. Nevco Inc Full Color, Red or Amber Message Centers.
 7. Nevco Inc Video Displays.

2.5 CONTROL CENTER

- A. **Type: Wireless**, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW as manufactured by Nevco Inc. Console will operate earlier scoreboards from Nevco Inc.
1. Unit shall comply with Part 15 of FCC Rules regarding interference.
 2. Console: High impact, break-resistant gray plastic 11 x 9-1/2 x 4-1/8 inches.
 3. Features:
 - a. Control can be used to operate both wireless and wired scoreboards.
 - b. Power on-off switch.
 - c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
 - d. Keyboard overlays for scoreboard or accessory.
 - e. Remote hand-held main time switch with integral horn button.
 - f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
 - g. Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and 1/10th second display during last minute.
 - h. Dimmer control for scoreboard.
 4. Receiver: Sturdy impact resistant construction, 6 x 4 x 1.5 inches with 4 inch antenna and mounted at scoreboard.
 5. Maximum range: 1,000 feet from control center to receiver.
 6. Power adapters: Provide for each control center.
 - a. Input: 120 volts, 0.4 amps, 50/60 Hz.
 - b. Output: 9 volts, 1.67 amps, 15 watts.
 7. Provide option of battery supply for control operation if utility power not available.
 8. Provide carrying case for control center and hand-held switch; Model CC-3 as manufactured by Nevco Inc.
 - a. Size: 18-1/2 x 14-1/2 x 6 inches.
 - b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify exact scoreboard and control center quantities and junction box locations with Architect.
- B. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards.
- C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

- A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
- B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
- C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
- D. Clean exposed surfaces.
- E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

- A. In accordance with Starting, Adjusting, and Demonstrating, provide demonstration and training session for Owner's representative covering operation and maintenance of electronic scoreboard.

END OF SECTION 266000

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- Grounding conductors.
 - Grounding connectors.
 - Grounding busbars.
 - Grounding rods.
 - Grounding labeling.

1.2 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. SBB: Secondary bonding busbar.
- D. PBB: Primary bonding busbar.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
- Ground rods.
 - Ground and roof rings.
 - BCT, PBB, SBBs, and routing of their bonding conductors.
- B. Qualification Data: For Installer, installation supervisor, and field inspector.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
- Installation Supervision: Installation shall be under the direct supervision of ITS Technician who shall be present at all times when Work of this Section is performed at Project site.
 - Field Inspector: Currently registered by BICSI as ITS Installer 2 to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with TIA-607-E.

2.2 CONDUCTORS

- A. Comply with UL 486A-486B.

- B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - Cable Tray Equipment Grounding Wire: No. 6 AWG.
- C. Bare Copper Conductors:
 - Solid Conductors: ASTM B 3.
 - Stranded Conductors: ASTM B 8.
 - Tinned Conductors: ASTM B 33.
 - Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
 - Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 - Electroplated tinned copper, C and H shaped.
- C. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- A. PBB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as PBB and shall comply with TIA-607-E.
 - Predrilling shall be with holes for use with lugs specified in this Section.
 - Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 - Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- B. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-E.
 - Predrilling shall be with holes for use with lugs specified in this Section.
 - Mounting Hardware: Stand-off brackets that provide at least a 2-inch ((50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 - Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-607-E. Predrilling shall be with holes for use with lugs specified in this Section.

- Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
- Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
- Rack-Mounted Vertical Busbar: 72 or 36 inches ((1827 or 914 mm) long, with) stainless-steel or copper-plated hardware for attachment to the rack.

2.5 GROUND RODS

- A. Ground Rods: Copper-clad; 3/4 inch by 10 feet in diameter.

2.6 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with TIA-607-E.

3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- The bonding conductors between the SBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
 - The bonding conductors between the PBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
- B. Conductor Terminations and Connections:
- Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - Connections to Ground Rods at Test Wells: Bolted connectors.
 - Connections to Structural Steel: Welded connectors.
- C. Conductor Support:

- Secure grounding and bonding conductors at intervals of not less than 36 inches ((900 mm).)
- D. Grounding and Bonding Conductors:
- Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 - Install without splices.
 - Support at not more than 36-inch (900-mm) intervals.
 - Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a SBB.

3.4 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.5 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
- Use crimping tool and the die specific to the connector.
 - Pretwist the conductor.
 - Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the PBB with insulated bonding conductor.
- E. Interconnections: Interconnect all SBBs with the PBB with the telecommunications backbone conductor. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG 168 kcmils (85 sq. mm) unless otherwise indicated.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB No. 2 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each SBB to the ground bar of the panelboard.

- I. Shielded Cable: Bond the shield of shielded cable to the SBB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the SBB.

3.6 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - Label PBB(s) with "XXX-PBB," where "XXX" is the telecommunications space identifier for the space containing the PBB.
 - Label SBB(s) with "XXX-SBB," where "XXX" is the telecommunications space identifier for the space containing the SBB.
 - Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a PBB and a SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB. Maximum acceptable ac current level is 1 A.
- C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds **5** ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 270526

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Conduits, fittings, innerduct, surface pathways, outlet and floor boxes, pull boxes, enclosures, and pathway accessories for communications systems.
- B. Related Requirements: Coordinate with Section 260533 "Raceways and Boxes for Electrical Systems," Section 270526 "Grounding and Bonding for Communications Systems," and cable tray, handhole, and equipment requirements indicated on Drawings.
- C. Coordinate electrical and telecommunications Installer responsibilities with T00.01. Coordinate security pathways with TY sheets and approved equipment submittals.

1.2 ACTION SUBMITTALS

- A. Product Data: For each pathway and accessory type; include listings, environmental ratings, dimensions, and installation instructions.
- B. Shop Drawings: Show routes, sizes, pull points, sleeves, penetrations, floor boxes, and custom enclosures. Coordinate with cable quantities, equipment, building structure, and other trades.
- C. Closeout Submittals: Provide record drawings showing concealed routes, pull points, spare pathways, and identifiers; include final inspection reports.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI/TIA-569-E, Telecommunications Pathways and Spaces, including applicable addenda, and NFPA 70 as adopted by the authority having jurisdiction. Use products listed and labeled for their application where required. Resolve conflicting requirements with Architect before installation.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Rigid Galvanized Steel Conduit (RGS): Comply with ANSI C80.1 and UL 6.
- B. Electrical Metallic Tubing (EMT): Comply with ANSI C80.3 and UL 797.
- C. Fittings: Listed for the conduit type, location, and application; comply with UL 514B. Provide steel setscrew or compression fittings for EMT and threaded fittings for RGS. Provide insulated bushings and bonding fittings where indicated.
- D. Expansion and Movement Fittings: Compatible with the conduit system, rated for the environment, and suitable for expected movement. Maintain required bonding continuity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Rigid PVC Conduit: Schedule 40 or Schedule 80 as indicated on the drawings; comply with NEMA TC 2 and UL 651. Provide matching fittings complying with NEMA TC 3.
- B. Joining Materials: Manufacturer-approved for the conduit and installation conditions. Comply with applicable project requirements for emissions and environmental exposure.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Optical-Fiber Pathways: Where indicated, provide listed pathways complying with UL 2024, with ratings suitable for the actual plenum, riser, general-use, or other installation environment.
- B. Innerduct: Provide type, size, and number of cells indicated on Drawings, compatible with the host conduit and cable. Provide continuous usable cells with pulling media and associated fittings.

2.4 SURFACE PATHWAYS

- A. Surface Pathways: Provide only where indicated. Use listed systems with compatible fittings, boxes, covers, and required barriers. Nonmetallic systems shall comply with UL 5A. Coordinate finish and color with Architect.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Outlet and Device Boxes: Listed metal boxes with covers and plaster rings to suit devices and finishes. Typical boxes shall be 4-11/16 inches square by 2-1/8 inches deep; provide larger or deeper boxes where indicated or required for the device and cable bend radius.
- B. Floor Boxes: Listed metal assemblies suitable for the floor construction and installation environment, with covers, device plates, and required power/communications separation. Provide Types A and B as detailed on T05.02; coordinate locations with furniture and structural work.
- C. Pull and Junction Boxes: Metal boxes sized for conduit entries, pulling access, and cable bend radius; provide accessible covers. Use gasketed, rated assemblies where exposed to weather or moisture.
- D. Enclosures and Cabinets: Listed assemblies with environmental ratings specified in Part 3, compatible mounting panels, covers or hinged doors, and required barriers. This article covers pathway enclosures; provide the telecommunications equipment cabinet as detailed on T04.11.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Use RGS for exposed conduit. Use Schedule 80 PVC below grade unless otherwise indicated; provide concrete encasement and rigid steel transitions at building entrances as detailed on T05.01. Aboveground boxes and enclosures shall be NEMA Type 3R minimum, with higher ratings where required by exposure.
- B. Indoors: Use EMT in dry locations; use RGS where subject to severe physical damage or in damp or wet locations. Use flexible conduit only where specifically detailed, with length and type suited to the application.
- C. Boxes and Enclosures: NEMA Type 1 in dry interior locations; NEMA Type 4 stainless steel in commercial kitchens and damp or wet interior locations, unless a higher rating is required.
- D. Conduit Size: Minimum 1-inch trade size unless otherwise detailed. Use sizes indicated and increase where required for cable quantities, bend radius, and permitted fill. Do not exceed 40 percent conduit fill or more restrictive drawing or code requirements.

3.2 INSTALLATION

- A. Install complete, usable pathways in accordance with ANSI/TIA-569-E, NFPA 70, Drawings, and manufacturer instructions. Coordinate routes, clearances, and access with other trades before rough-in.
- B. Conceal pathways in finished construction unless indicated otherwise. Support independently from building structure with hardware suitable for the load and environment. Maintain separation from heat sources and electrical systems as required.
- C. Pull Points: For interior conduit runs, provide accessible pull boxes at intervals not exceeding 100 feet and before exceeding two 90-degree bends or equivalent. For outside plant, follow the indicated pull-point spacing. Reduce lengths and bends where required by cable pulling limits or ANSI/TIA-569-E; do not use boxes in place of bends.
- D. Bends and Terminations: Use smooth bends that maintain required cable bend radius. Remove sharp edges and provide insulated bushings or suitable cable-entry protection. Complete pathway bonding in accordance with Section 270526 and the bonding details.

- E. Pulling Media: Provide pull strings or tapes in conduits and each innerduct cell as indicated, including spare pathways. Use ratings specified for the application and replace media displaced by cable installation. Cap spare and unfinished underground pathways against water and debris.
- F. Sealing and Movement: Seal building entrances and transitions between environments as required to prevent water, gas, or condensation migration. Provide expansion fittings at building movement joints and wherever expected movement requires them; install per manufacturer instructions.
- G. Boxes: Install at indicated heights and locations with accessible covers. Coordinate device depths, wall finishes, and opposite-side boxes to preserve fire and acoustic ratings. Coordinate floor boxes with furniture and structural requirements before rough-in.
- H. Identification: Label pathways, pull boxes, and spare conduit destinations in accordance with Drawings and ANSI/TIA-606-D. Coordinate identifiers with record drawings.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Provide sleeves and seals at exterior wall and floor penetrations; maintain weather, water, and structural integrity. Coordinate opening locations with architectural and structural work. Follow the entrance and sleeve details on T05.01.

3.4 FIRESTOPPING

- A. Provide listed firestop systems appropriate to each rated assembly and the actual penetrants. Maintain required fire and smoke ratings, including spare sleeves, and coordinate with architectural requirements.

3.5 PROTECTION

- A. Protect pathways and finishes from damage and contamination. Clean interiors before cable installation; repair or replace damaged components and maintain seals and temporary closures.

3.6 FIELD QUALITY CONTROL

- A. Inspect completed pathways for correct material, size, support, fill allowance, bend radius, access, bonding, identification, and penetration sealing. Verify clear passage before cable installation, correct deficiencies, and submit inspection reports.

END OF SECTION 270528

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Wire-basket cable tray, ladder cable runway, supports, fittings, bonding accessories, and warning signs for communications cabling.
- B. Related Requirements: Coordinate with Section 270528 "Pathways for Communications Systems" and Section 270526 "Grounding and Bonding for Communications Systems." Coordinate electrical and telecommunications Installer responsibilities with T00.01.

1.2 ACTION SUBMITTALS

- A. Product Data: For each tray, runway, support, and accessory type; include materials, finishes, load ratings, span limitations, applicable listings or classifications, and installation instructions.
- B. Shop Drawings: Show sizes, routes, elevations, supports and attachments, fittings, clearances, wall crossings, and bonding connections. Identify installed and planned future cable loads and demonstrate compliance with support and load requirements.

1.3 INFORMATIONAL SUBMITTALS

- A. Structural and Seismic Data: Provide manufacturer load/span information. Submit seismic qualification and anchorage information where required by project structural criteria and applicable code.
- B. Field Quality-Control Reports: Include inspections, continuity test results, deficiencies, and corrections. Provide record drawings showing installed tray routes and bonding connections.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Provide complete, compatible systems identified for the application under NFPA 70. Comply with ANSI/TIA-569-E, including applicable addenda, and adopted NFPA 70. Apply NEMA BI-50015 (formerly VE 1) to metal cable tray systems within its scope and manufacturer requirements to telecommunications runway assemblies.
- B. Sizes and Configurations: As indicated on Drawings. Provide 12-inch-wide by 4-inch-deep basket tray where tagged on T01.11 and 18-inch-wide ladder runway in Utility Room 119 as shown on T04.11. Coordinate elevations and transitions before installation.
- C. Structural Performance: Support the tray or runway, installed cabling, and planned future cabling at the actual support spans without exceeding manufacturer ratings. Provide compatible supports, fasteners, and structural attachments for those loads.
- D. System Components: Provide tray or runway and associated fittings, splices, and accessories from the same manufacturer or approved compatible components. Cable-bearing surfaces shall be smooth and free of sharp edges.

2.2 WIRE-BASKET CABLE TRAY

- A. Configuration: Welded-steel wire-mesh tray designed for telecommunications cabling, with width as indicated and minimum usable load depth of 4 inches. Provide manufacturer-standard sections and fittings, including bend-radius protection at changes in direction and cable exits.
- B. Materials and Finish: Welded carbon-steel wire with electrogalvanized zinc finish complying with ASTM B633 in dry interior locations. Provide corrosion protection suitable for other indicated environments and compatible corrosion-resistant hardware.

- C. Load Rating: Select tray and supports for the installed and planned future cable load at manufacturer-approved spans. Provide manufacturer load/span data; additional support at fittings and transitions shall follow system requirements.

2.3 LADDER CABLE TRAY

- A. Configuration: Open steel telecommunications cable runway with two longitudinal side stringers and welded transverse cross members. Provide width indicated on Drawings and compatible fittings, splices, and cable-radius accessories.
- B. Load Rating: Minimum uniformly distributed load of 132 lb/ft at a maximum 5-foot support span, with minimum safety factor of 1.5. Shorter spans shall be used where required by actual loading, manufacturer instructions, or field conditions.
- C. Finish: Manufacturer-applied black corrosion-resistant finish over zinc protection, with compatible hardware suitable for the installation environment.
- D. Classification: Provide UL Classified runway assemblies for the intended application. Where a system is used as an equipment grounding conductor, provide the classification and capacity required for that use by NFPA 70.

2.4 CABLE TRAY ACCESSORIES

- A. Provide required bends, tees, crosses, reducers, elevation changes, radius drops, splice assemblies, supports, and bonding components compatible with the tray or runway. Maintain cable bend radius and mechanical continuity.
- B. Provide barriers, covers, and bottom inserts where indicated or required for the application. Coordinate accessories with cable ventilation, allowable loading, and fire-performance requirements.

2.5 WARNING SIGNS

- A. Provide durable, conspicuous warning signs on or near accessible tray runs stating that trays shall not be used as walkways, ladders, or supports for personnel. Coordinate identification with Section 270553 "Identification for Communications Systems."

2.6 SOURCE QUALITY CONTROL

- A. Provide manufacturer documentation of load ratings and applicable testing or classification. For metal cable tray systems within its scope, comply with applicable NEMA BI-50015 (formerly VE 1) testing requirements.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install complete systems in accordance with manufacturer instructions, applicable NEMA BI-50016 (formerly VE 2) guidance, ANSI/TIA-569-E, NFPA 70, and Drawings. Resolve conflicting routing, support, or clearance requirements with Architect before installation.
- B. Supports: Attach to building structure independently of ceiling grids, ceiling wires, ducts, piping, and other building systems. Use the wall brackets or other support arrangements indicated, sized for the actual load. Do not support tray weight on equipment enclosures.
- C. Tray Use: Do not use trays to support unrelated equipment or building services. Raceway interfaces shall use approved fittings and coordinated support arrangements; do not impose loads beyond the tray system rating.
- D. Movement and Finish: Provide expansion or movement fittings where required. Protect field-cut surfaces and remove sharp edges in accordance with manufacturer instructions. Maintain mechanical and bonding continuity at splices and fittings.

- E. Wall Crossings: Do not carry trays through walls. Provide conduit sleeves and support on each side as required by T00.01 and Section 270528. Maintain fire, smoke, acoustic, and environmental ratings at penetrations, including spare sleeves.
- F. Access and Separation: Maintain indicated access clearances and required separation from power conductors and interference sources. Coordinate wall-mounted and overhead arrangements with structure and other trades. Keep installation and maintenance access unobstructed.

3.2 CABLE TRAY GROUNDING

- A. Bond trays and runway to the telecommunications bonding system in accordance with Section 270526, ANSI/TIA-607-E, NFPA 70, and Drawings. Use listed bonding connections or bonding jumpers where needed to maintain continuity across sections, fittings, and movement joints.
- B. Coordinate the ladder runway bond to the PBB in Utility Room 119. Bond raceway interfaces as detailed, including No. 6 AWG bushing-to-tray bonds at Detail 12/T05.01. Telecommunications bonding does not replace required power-circuit equipment grounding.

3.3 CABLE INSTALLATION

- A. Install cabling after tray runs and bonding are complete and inspected. Distribute cables to remain within fill and load limits and maintain cable bend radius and planned spare capacity.
- B. Secure cable bundles with reusable hook-and-loop ties as indicated on T00.01. Support vertical runs and cable drops using compatible accessories in accordance with cable and tray manufacturer instructions; avoid jacket deformation or unsupported cable strain.
- C. Fill: Do not exceed the initial and future fill limits indicated on Drawings, the usable tray depth, or applicable code and manufacturer limits. Show fill and planned future capacity in submittals; do not treat a generic maximum fill depth as permission to exceed the actual tray depth.

3.4 CONNECTIONS

- A. Connect raceways and cable exits with compatible fittings providing smooth cable transitions and required bend-radius protection. Coordinate mechanical support and bonding with T05.01 and Sections 270528 and 270526.

3.5 FIELD QUALITY CONTROL

- A. Inspect sizes, routing, support attachments, loading, fill, access, cable separation, fittings, edge protection, signs, and bonding. Confirm that tray interiors are clean and free of unrelated services or obstructions.
- B. Test bonding continuity in accordance with Section 270526 and approved test procedures and acceptance criteria. Correct deficiencies, repeat affected tests, and submit final inspection and test reports.

3.6 PROTECTION

- A. Protect tray systems, finishes, and cabling from damage and contamination. Repair or replace damaged components. Do not permit trays or runways to be used as walkways or supports for personnel.

END OF SECTION 270536

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide telecommunications backboards, wall-mounted equipment cabinets, patch-panel housings, cable management, UPS, bonding accessories, and identification indicated on Drawings. Coordinate cabling and terminations with Section 271500, pathways with Section 270528, and ladder tray with Section 270536.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit cabinet dimensions, usable depth, load ratings, mounting requirements, ventilation, accessories, patch-panel capacity, and UPS electrical ratings, runtime curves, connections, and listings.
- B. Shop Drawings: Show Room 119 plans and cabinet elevations, rack-unit assignments, equipment weights, anchorage and wall support, clearances, cable routes, bonding, and power connections. Include Owner equipment and required spare capacity. Demonstrate access with the cabinet open and loaded.
- C. UPS Calculations: Submit connected VA/W load, required runtime, battery arrangement, total installed weight, heat output, and branch-circuit requirements. Coordinate with Owner/IT and electrical work before procurement.

1.3 INFORMATIONAL SUBMITTALS

- A. Submit Installer qualifications, field inspection and startup reports, record cabinet elevations, port schedules, operating and maintenance information, keys, and applicable warranty documents.

1.4 QUALITY ASSURANCE

- A. Use experienced telecommunications Installers with BICSI-certified supervision and qualified inspection personnel. Comply with adopted NFPA 70, ANSI/TIA-569-E, manufacturer instructions, and applicable equipment listings.
- B. Coordinate equipment fit, wall reinforcement, service-provider demarcation, power, cooling, and Owner-furnished network equipment before installation. Maintain clearances and spare capacity indicated on Drawings.

PART 2 - PRODUCTS

2.1 BACKBOARDS

- A. Provide 3/4-inch fire-retardant-treated plywood backboards, with extent, mounting, and finish shown on T04.11. Preserve the manufacturer treatment stamp. Apply the indicated gray finish without obscuring identification; coordinate coating compatibility with the treated plywood.

2.2 WALL MOUNTED RACKS

- A. Provide the 26-RU, 19-inch wall-mounted swing-out steel cabinet indicated on T04.11, with reversible locking transparent front door, locking center section, adjustable rails, bonding provisions, and compatible mounting hardware. Coordinate keying with Owner.
- B. Provide at least 30 inches usable equipment depth as indicated on T04.11 and a rated equipment load capacity of at least 200 lb. Verify actual loaded weight, including UPS and batteries, and wall support. Do not exceed the manufacturer rating in the open or closed position.
- C. Provide passive ventilation as indicated and demonstrate suitability for the installed heat load and room conditions. Ventilation fans shall be provided with wall mounted cabinet.

- D. Provide internal vertical and rack-mounted horizontal cable management, protected cable entries, strain relief, and accessories indicated. Maintain bend radii and sufficient movement for the swing-out section without straining cables. Preserve the indicated 25 percent spare rack capacity.

2.3 PATCH PANELS AND FIBER HOUSINGS

- A. Copper Panels: Provide compatible 19-inch modular patch panels, with the 48-port, 2-RU arrangement indicated on T04.11. Provide capacity for installed cables plus 25 percent spare ports. Coordinate connector category, patch cords, and testing with Section 271500; provide support bars and permanent port labels.
- B. Rack Fiber Housing: Provide the indicated 1-RU housing capable of accommodating 48 fibers, with accessible modular panels/cassettes, strain relief, bend-radius control, splice protection where required, and identification. Housing capacity does not establish installed fiber quantity.
- C. Wall Fiber Housing: Provide the indicated service-provider interface housing with compatible adapters, pigtails, splice storage, and labeling for the actual termination scope. Coordinate Contractor and provider responsibilities before purchasing components.
- D. Provide compatible LC adapters and pigtails where indicated, matching cable fiber type. Use fusion-splice cassettes where required by the approved termination arrangement.

2.4 UNINTERRUPTIBLE POWER SUPPLY

- A. Provide a rack-mounted, line-interactive UPS with sine-wave output, automatic voltage regulation, replaceable batteries, status display, audible trouble alarms, and network monitoring compatible with Owner/IT. Provide listed UPS equipment complying with UL 1778 and manufacturer-supported mounting accessories.
- B. Coordinate the 3000-VA UPS designation on T04.11 with the Working specification rating of 2880 VA/2700 W at 120 V.
- C. Account for battery and accessory weight, usable cabinet depth, ventilation, and rack space. Coordinate any external batteries with the cabinet layout and support design.
- D. Coordinate the proposed NEMA L5-30P input with electrical branch-circuit and receptacle provisions. Provide output receptacles or compatible listed rack power distribution to serve connected equipment. Do not daisy-chain power strips.

2.5 GROUNDING

- A. Provide grounding and bonding components under Section 270526 and ANSI/TIA-607-E. Coordinate the PBB shown in Room 119 and any SBBs indicated. Avoid duplicating busbars or establishing a separate grounding electrode system under this Section.

2.6 LABELING

- A. Provide durable machine-printed labels complying with ANSI/TIA-606-D and applicable UL 969 requirements. Coordinate identifiers with Owner/IT, Drawings, and Section 271500.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate service-provider entrance and demarcation locations, equipment space, protection, and installation responsibilities. Provide the indicated backboards and housings without assuming responsibility for provider-owned active equipment. Coordinate entrance pathways with Section 270528.

3.2 INSTALLATION

- A. Verify wall construction, reinforcement, equipment clearances, power, and environmental conditions before mounting. Secure backboards and cabinets to supports suitable for the complete installed load using manufacturer-approved anchorage. Do not rely on gypsum board alone for support.
- B. Install equipment to the approved cabinet elevation, maintaining access, spare capacity, ventilation, and separation from power circuits. Coordinate Owner-furnished equipment dimensions and weights. Place heavy equipment, including UPS, in manufacturer-permitted locations with the required support rails.
- C. Route and support cables neatly without exceeding bend limits or loading connectors. Protect entries and preserve full cabinet movement. Coordinate patch-panel installation and termination with Section 271500; maintain fiber polarity and protect unused ports.

3.3 PENETRATIONS AND FIRESTOPPING

- A. Seal exterior penetrations against moisture and maintain rated wall/floor assemblies using listed firestop systems suited to the penetrants. Coordinate sleeves, seals, and firestopping with Section 270528 and architectural requirements.

3.4 GROUNDING AND BONDING

- A. Bond cabinets, racks, metallic panels, and associated components as required by Section 270526, ANSI/TIA-607-E, NFPA 70, and manufacturer instructions. Provide bonding across movable components where required; preserve electrical equipment grounding and coordinate shield terminations with the installed cabling system.

3.5 IDENTIFICATION

- A. Identify cabinets, panels, ports, and bonding connections consistently with approved schedules and ANSI/TIA-606-D. Preserve backboard treatment markings and provide the finish identification required by Drawings. Deliver records matching the installed arrangement.

3.6 FIELD QUALITY CONTROL AND CLOSEOUT

- A. Inspect anchorage, cabinet operation, equipment fit, clearances, loading, spare capacity, cable management, labels, bonding, and firestopping. Correct deficiencies before acceptance. Perform cable certification under Section 271500.
- B. Demonstrate UPS normal operation, transfer to battery, restoration, alarms, and network monitoring at the approved load. Verify runtime using manufacturer data and the approved startup/test procedure. Record load, settings, test results, and corrective work.
- C. Provide final equipment and port schedules, UPS configuration and battery-maintenance information, keys, and operating instructions. Train Owner personnel in cabinet access, UPS operation, alarms, shutdown, and routine maintenance.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Horizontal copper cabling, connecting hardware, patch panels, outlets, patch cords, identification, and testing; optical fiber cabling and hardware where indicated as Contractor scope.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate outlet counts, locations, cable categories, patching, and service-provider interfaces with Drawings and Owner/IT. Coordinate pathways, trays, and bonding with Sections 270528, 270536, and 270526.

1.3 ACTION SUBMITTALS

- A. Product Data: For each cable and hardware type, including ratings, listings, compatibility, and manufacturer installation requirements.
- B. Shop Drawings: Show outlet and cable schedules, categories, routes, patch-panel assignments, rack elevations, labeling, and patch-cord quantities. Identify fiber type, strand count, connectors, and loss budgets where fiber is included.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit Installer qualifications, manufacturer compliance data, proposed test procedures and acceptance criteria, and final field test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Provide record drawings, cable/port schedules, electronic certification results and readable summaries, maintenance data, and applicable warranty documents. Use consistent identifiers throughout.

1.6 QUALITY ASSURANCE

- A. Installer: Experienced in systems of similar scope, with BICSI-certified personnel supervising installation and qualified personnel performing certification testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inspect deliveries for damage and product identification. Store and handle cables within manufacturer environmental limits; protect ends and replace damaged products.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Provide continuous horizontal links between the serving patch panels and outlets indicated. Do not splice copper horizontal cable or provide bridged taps. Provide consolidation points only where indicated and permitted by the applicable cabling standard.

2.2 PERFORMANCE REQUIREMENTS

- A. Comply with ANSI/TIA-568.0-E and ANSI/TIA-568.1-E, including applicable addenda; ANSI/TIA-568.2-E for balanced copper; and ANSI/TIA-568.3-E for optical fiber. Provide complete links meeting their specified category or fiber performance requirements.
- B. Provide cables listed for the actual installation environment under adopted NFPA 70. Select plenum, riser, and wet-location ratings as applicable; plenum or riser designation alone does not establish wet-location suitability.

2.3 UTP CABLE

- A. Provide 100-ohm, four-pair unshielded balanced twisted-pair cable: Category 6 for general outlets and Category 6A for WAPs unless otherwise indicated. Use UL 444-listed cable with jacket color coordinated with Owner/IT and Drawings.
- B. Use CMP cable in environmental air spaces; CMR or other permitted listed cable where appropriate to the installation. Provide wet-location cable wherever pathways are wet, including below-grade or slab-on-grade conditions as applicable.

2.4 FIBER OPTIC CABLING

- A. Where indicated, provide dielectric optical fiber cable complying with ANSI/TIA-568.3-E and applicable ANSI/ICEA S-83-596 requirements. Fiber type, strand count, classification, connectors, and jacket rating shall match the Drawings and installed environment.
- B. Provide continuous fiber between designated terminations without intermediate splices unless indicated. Coordinate Contractor and service-provider scope; patch-panel capacity does not establish required cable strand count.

2.5 UTP CABLE HARDWARE

- A. Provide compatible patch panels, jacks, and termination hardware complying with ANSI/TIA-568.2-E, rated for the installed cable category or higher. The complete link shall meet the specified category; terminate consistently using T568A as detailed on T05.02.
- B. Patch Cords: Factory-terminated four-pair cords matching the link category, with strain relief and protected latches. Coordinate lengths, colors, and quantities with Owner/IT. Provide patch-panel capacity and spare ports indicated on T04.11.

2.6 FIBER OPTIC CABLE CONNECTING HARDWARE

- A. Provide compatible fiber housings, adapters, connectors, and termination accessories complying with ANSI/TIA-568.3-E. Factory-terminated and tested patch cords shall match fiber type, connector type, polarity, and equipment interfaces.
- B. Provide panel capacity and accessories indicated on T04.11 and T05.02. Coordinate patch-cord quantities and lengths with Owner/IT and the actual fiber scope.

2.7 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Provide eight-position modular jacks matching cable category, with faceplate style, port count, mounting, and color as indicated on Drawings. Fit unused openings with blanks; coordinate with electrical finishes and floor boxes.
- B. Wall Phone Outlets: Provide the faceplate and jack arrangement detailed on T05.02; coordinate telephone mounting provisions with the selected device. Provide WAP outlet assemblies and cable quantities shown on Drawings.

2.8 GROUNDING

- A. Provide bonding components in accordance with Section 270526 and ANSI/TIA-607-E. Coordinate metallic panels, housings, and cable components requiring bonding with the installed system.

2.9 IDENTIFICATION PRODUCTS

- A. Provide durable, machine-printed labels suitable for each surface and environment, complying with ANSI/TIA-606-D and applicable UL 969 requirements. Coordinate identifiers and colors with Owner/IT and Drawings.

2.10 SOURCE QUALITY CONTROL

- A. Provide manufacturer documentation demonstrating specified cable and component performance. Factory tests do not replace certification of installed links.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate service-provider demarcation and Owner equipment interfaces without extending Contractor cabling scope beyond the Contract Documents.

3.2 WIRING METHODS

- A. Use pathways and trays indicated on Drawings and specified in Sections 270528 and 270536. Use open-cable supports only where indicated or approved; do not substitute exposed cabling for required conduit. Maintain required separation from power and interference sources under ANSI/TIA-569-E and NFPA 70.

3.3 INSTALLATION OF CABLES

- A. Install and terminate in accordance with applicable ANSI/TIA-568 requirements and manufacturer instructions. Maintain cable geometry, bend radius, pulling limits, and environmental limits. Replace damaged cable; do not repair horizontal copper cable by splicing.
- B. Independently support cables with suitable supports and reusable hook-and-loop ties as indicated. Do not rest cables on ceiling grids or unrelated services. Support bundles and equipment transitions without jacket deformation or strain on terminations.
- C. Copper: Terminate all pairs at scheduled outlets and patch panels; maintain consistent pin assignments. Route links within standard length limits, accounting for service slack and patch cords. Provide two Category 6A cables at each WAP as indicated on T00.01.
- D. Fiber: Maintain polarity, protect and clean connector end faces, and provide organized slack for termination and maintenance. Maintain bend radius and strain relief within housings and at transitions.
- E. Service Slack: Provide the outlet and equipment-room slack indicated on Drawings. Store loops neatly within link-length limits and manufacturer bend-radius requirements; coordinate space in the Room 119 wall cabinet.

3.4 FIRESTOPPING

- A. Maintain rated wall and floor assemblies using listed firestop systems appropriate to the installed cables, sleeves, and penetrations. Coordinate with Section 270528 and architectural requirements.

3.5 GROUNDING

- A. Bond metallic components requiring bonding in accordance with Section 270526, ANSI/TIA-607-E, NFPA 70, and manufacturer instructions. Preserve required power-circuit equipment grounding.

3.6 IDENTIFICATION

- A. Identify both ends of every cable, outlets, patch-panel ports, and fiber strands using ANSI/TIA-606-D and the approved project labeling scheme. Follow T05.02 details and coordinate actual room identifiers with Drawings.
- B. Provide final cable and port schedules matching labels, record drawings, and test reports. Submit electronic records in an Owner-approved format and post the serving-room cable schedule.

3.7 FIELD QUALITY CONTROL

- A. Inspect cable ratings, category compatibility, routing, supports, terminations, labeling, bonding, and firestopping before acceptance. Submit test procedures and acceptance criteria before testing.
- B. Copper Certification: Test every installed link to its Category 6 or Category 6A permanent-link limits under ANSI/TIA-568.2-E. Use calibrated field certification equipment meeting applicable ANSI/TIA-1152 requirements and manufacturer-approved adapters for the test configuration.
- C. Include all required transmission and DC-resistance measurements in the selected standard test suite. Address Category 6A alien-crosstalk verification under the applicable standard and approved test plan; document the method and extent. Test any specifically indicated alternate link configuration to its applicable limits.
- D. Fiber Certification: Test every installed strand for continuity, polarity, length, and insertion loss using an OLTS at applicable wavelengths under ANSI/TIA-568.3-E and applicable ANSI/TIA-526 methods. Compare measured loss with the approved link-loss budget; test directions as required. Perform OTDR testing where specified.
- E. Reports: Identify each link or strand, test configuration, instrument and calibration information, applicable limits, measured results, and pass/fail status. For fiber, include wavelengths, directions, and loss budgets. Correct failures and retest; submit complete final results.

3.8 FINAL VERIFICATION TESTS

- A. Verify completed schedules, labels, patching, and certification results. Coordinate operational checks with Owner/IT when active services and equipment are available; operational checks do not replace cable certification.

3.9 DEMONSTRATION

- A. Instruct Owner personnel in labeling, patching, cable records, test-report access, and maintenance of the installed cabling system.

END OF SECTION 271500

SECTION 271533 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Complete CATV coaxial cabling and distribution system, including cables, connectors, outlets, distribution equipment, entrance protection, bonding, identification, and testing, to the extent indicated.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit cable ratings and attenuation, connectors, outlets, amplifiers, splitters, taps, surge devices, and accessories. Identify operating bandwidth, impedance, gain/loss, isolation, return loss, output limits, listings, and installation requirements as applicable.
- B. Shop Drawings: Show the provider interface, distribution diagram, cable types and lengths, outlet identifiers, equipment locations, tap values, power, entrance protection, and bonding connections. Coordinate with Room 119 and Drawings.
- C. Signal-Level Calculations: Submit losses and gains from the provider interface to every outlet at representative frequencies across the operating band. Identify assumed input levels, component values, and predicted outlet levels; demonstrate acceptable balance without equipment overload. Verify assumptions against actual service before final balancing.

1.3 INFORMATIONAL SUBMITTALS

- A. Submit Installer qualifications, manufacturer instructions, and proposed test procedures and acceptance criteria. Establish operating band, required signal levels, and applicable signal-quality criteria with Owner and service provider before equipment selection and testing.
- B. Field Reports: Submit measured levels at the entrance, amplifier inputs and outputs, distribution test points, and every outlet; include frequencies/channels, equipment settings, acceptance limits, and corrected deficiencies.

1.4 CLOSEOUT SUBMITTALS

- A. Provide operation and maintenance data, final distribution diagram, cable/outlet schedules, component and tap values, amplifier settings, and final test reports. Records and labels shall use consistent identifiers.

1.5 QUALITY ASSURANCE

- A. Installer: Experienced in broadband CATV systems of similar scope, with personnel trained in the selected products. Use personnel experienced in RF distribution design for calculations and balancing, and qualified personnel for testing; provide RCDD oversight of telecommunications coordination and records.
- B. Use calibrated instruments appropriate to the operating band, signal format, and measurements required by the approved test plan.

1.6 COORDINATION

- A. Coordinate service-provider and Contractor responsibilities, demarcation, input signal, operating band, and connection authorization with Owner and provider. Coordinate outlet locations and faceplates with Drawings and architectural finishes; resolve discrepancies before installation.
- B. Coordinate equipment power, ventilation, and access with electrical work; pathways and trays with Sections 270528 and 270536; and grounding and bonding with Section 270526.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide a complete, compatible 75-ohm broadband CATV system meeting ANSI/TIA-568.4-E and the approved service-provider and connected-equipment performance criteria throughout the operating band.
- B. Comply with ANSI/TIA-569-E for pathways and spaces, ANSI/TIA-607-E for telecommunications bonding, and adopted NFPA 70. Provide listed products where required for the use and installation environment.
- C. Provide acceptable signal levels and quality at every outlet without overloading amplifiers or connected equipment. Use the approved signal-level calculations to coordinate component selection and settings.

2.2 CATV COAXIAL CABLE

- A. Provide 75-ohm coaxial cable of the types and sizes indicated. RG-6/U and RG-11/U shall have low-loss foam dielectric and quad shielding, with nominal 18 AWG and 14 AWG copper-covered steel center conductors, respectively. Provide black jackets unless otherwise indicated.
- B. Provide hardline cable only where indicated, sized for the approved design and compatible with the selected connectors and equipment. Confirm cable conductor and powering compatibility with provider requirements.
- C. Provide NFPA 70 cable classifications suitable for each location, including plenum or riser ratings as applicable. Provide wet-location and outdoor ratings where exposed to those conditions; an indoor flame rating alone does not establish wet-location suitability.

2.3 CATV DISTRIBUTION EQUIPMENT

- A. Provide commercial-grade 75-ohm distribution equipment and accessories compatible with the cable, connectors, signal format, and operating band. Provide mounting, power supplies, and bonding provisions required for a complete system.
- B. Amplifiers: Provide field-adjustable gain and slope, suitable output capability, and noise/distortion performance for the approved design. Provide metal enclosures, F-type interfaces as applicable, and power supplies coordinated with the indicated electrical service.
- C. Splitters and Taps: Provide the port counts and tap values indicated or established by approved calculations, with suitable insertion loss, isolation, and return loss. Provide metal housings, permanent mounting provisions, and compatible F-type or hardline interfaces.
- D. Entrance Protection: Provide compatible coaxial surge-protection devices and grounding blocks where indicated or required by NFPA 70. Select devices for the operating band, system impedance, and installation environment; provide connections to the building grounding and bonding system.
- E. Accessories: Provide required attenuators, equalizers, adapters, and 75-ohm terminators for unused ports, compatible with system performance and powering requirements.

2.4 COAXIAL CABLE HARDWARE

- A. Connectors: Provide cable-matched F-type compression connectors for RG-6/U and RG-11/U, and compatible connectors for hardline. Maintain shield continuity and required RF performance. Do not use twist-on or crimp-type F connectors; provide environmental protection where required.
- B. Outlets and Faceplates: Provide 75-ohm F-type female outlet interfaces and faceplates matching the configuration, finish, and labeling provisions in compliance with TIA standards. Fit unused openings with blanks.
- C. Patch Cords: Provide factory-terminated cords of suitable length with compatible connectors, shielding, and performance. Minimize adapters and provide strain relief.

2.5 GROUNDING AND BONDING

- A. Provide bonding components complying with Section 270526, ANSI/TIA-607-E, NFPA 70, and equipment instructions. Coaxial grounding blocks and protection devices shall preserve required signal performance.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate the CATV entrance and demarcation with Owner and provider. Obtain their authorization before connecting to provider facilities. Install required entrance protection and bonding, and verify actual input levels before balancing.

3.2 INSTALLATION OF COAXIAL HORIZONTAL CABLES

- A. Install in accordance with manufacturer instructions, ANSI/TIA-568.4-E, NFPA 70, and the indicated pathways. Coordinate with Sections 270528 and 270536. Maintain required separation from power and interference sources under ANSI/TIA-569-E and NFPA 70.
- B. Provide continuous cable between designated termination points without intermediate splices unless indicated. Maintain manufacturer bend-radius, pulling, and environmental limits. Independently support cables without deformation or strain; replace damaged cables.
- C. Terminate with compatible connectors in accordance with manufacturer instructions. Preserve center-conductor and shield integrity; protect outdoor and wet-location connections against moisture.
- D. Provide neatly stored service slack sufficient for termination and maintenance within pathway capacity and bend-radius limits. Do not support cables on ceiling grids or unrelated services.

3.3 INSTALLATION OF CATV DISTRIBUTION EQUIPMENT

- A. Mount equipment securely at indicated accessible locations, with required ventilation and electrical power. Support equipment independently of cables, maintain proper port orientation, and terminate unused RF ports.
- B. Install the approved distribution configuration; obtain approval for changes affecting performance. Set amplifier gain and slope and select taps, attenuators, and equalizers to achieve the approved outlet criteria without overload.

3.4 FIRESTOPPING

- A. Maintain rated wall and floor assemblies using listed firestop systems appropriate to the cables, sleeves, and penetrations. Coordinate with Section 270528 and architectural requirements.

3.5 GROUNDING AND BONDING

- A. Bond equipment, metallic components, and cable shields as required by Section 270526, ANSI/TIA-607-E, NFPA 70, and manufacturer instructions. Preserve shield continuity; do not substitute the shield for a separately required equipment bonding conductor.
- B. Connect entrance protection and bonding to the building grounding and bonding system. Do not provide an independent telecommunications ground electrode. Complete required grounding and bonding before energizing equipment.

3.6 IDENTIFICATION

- A. Provide durable machine-printed identification complying with ANSI/TIA-606-D and the approved project scheme. Label both ends of cables, outlets, distribution equipment, and ports; coordinate with Drawings and Owner.
- B. Match identifiers to the final distribution diagram, cable/outlet schedules, and test reports. Use actual project room numbers and provide records in an Owner-approved electronic format.

3.7 FIELD QUALITY CONTROL

- A. Inspect all cabling, supports, connectors, equipment mounting, ratings, labeling, firestopping, entrance protection, and bonding before acceptance. Test every cable for center-conductor and shield continuity and absence of shorts before connection to equipment.
- B. Test the complete operating system at the entrance, amplifier inputs and outputs, distribution test points, and every outlet at representative frequencies across the operating band. Verify signal levels and applicable signal-quality criteria against the approved provider/equipment limits and test plan.
- C. Balance the system under its intended operating configuration without equipment overload. Recheck affected outlets after adjustments. If provider service is unavailable, document deferred operational tests and complete them when service becomes available before final system acceptance.
- D. Reports: Identify each test point, frequency/channel, measured result, acceptance limit, pass/fail status, instrument and calibration information, and final equipment settings. Correct deficiencies and retest affected work; submit complete final records.

END OF SECTION 271533

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. RS-232 cabling.
 - 2. RS-485 cabling.
 - 3. Low-voltage control cabling.
 - 4. Control-circuit conductors.
 - 5. Fire alarm wire and cable.
 - 6. Identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing. Fire alarm shall be supervised by a NICET Level III minimum.

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.

1.7 FIELD CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
- B. Environmental Limitations: Do not deliver or install UTP cable and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.3 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Polypropylene insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Plastic insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. Plastic jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.4 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.5 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.

2.6 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.7 FIRE ALARM WIRE AND CABLE

- 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. Comtran Corporation.
 2. Genesis Cable Products.
 3. West Penn Wire.

- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG; size as recommended by system manufacturer.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.8 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. HellermannTyton.
 - 2. 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 Section 260553 "Identification for Electrical Systems."

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install all fire alarm wiring in metal pathways and wireways.
 - 1. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
 - 2. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."
- B. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 - 4. Install conductors parallel with or at right angles to sides and back of enclosure.
 - 5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
 - 6. Mark each terminal according to system's wiring diagrams.
 - 7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 6. 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.
 - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 8. Pulling Cable: Comply with BICSI ITSM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- D. 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 (200 mm)** above ceilings by cable supports not more than **60 inches (1525 mm)** apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable **72 inches (1830 mm)** long shall be neatly coiled not less than **12 inches (300 mm)** in diameter below each feed point.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **5 inches (127 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **12 inches (300 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **24 inches (600 mm)**.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **2-1/2 inches (64 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **6 inches (150 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **12 inches (300 mm)**.
4. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **3 inches (75 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **6 inches (150 mm)**.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of **48 inches (1200 mm)**.
6. Separation between Cables and Fluorescent Fixtures: A minimum of **5 inches (127 mm)**.

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 260533 "Raceways and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. 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.

3.6 CONNECTIONS

- A. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

- A. Comply with requirements in Section 260523 "Firestop Systems and Acoustical Wall Sleeves." Also comply with all architectural firestop requirements.
- B. Comply with TIA-569-B, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

- A. For communications wiring, comply with J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 280513

SECTION 281300 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide the complete access-control system indicated, including management software, controllers, readers, credentials, monitored door interfaces, power supplies, batteries, cabling, programming, testing, and training. Coordinate with TY0.01 and TY1.11.

1.2 ACTION SUBMITTALS

- A. Product Data: Submit equipment schedules, listings, environmental ratings, system compatibility, software licenses, and manufacturer installation requirements.
- B. Shop Drawings: Show equipment and device locations, door identifiers, riser and wiring diagrams, conductor counts and sizes, conduit routes and sizes, junction boxes, power circuits, and interfaces. Submit DC voltage-drop and eight-hour battery/charger calculations for connected loads.
- C. Door Sequence Schedule: Identify each controlled opening, hardware, reader, door contact, request-to-exit device, lock power, normal operation, and response to fire alarm, power loss, communication loss, and reset. Coordinate with architectural hardware and fire-alarm documents before rough-in.

1.3 INFORMATIONAL SUBMITTALS

- A. Submit Installer qualifications, proposed test procedures, and final field test reports. Obtain County IT approval of system shop drawings and equipment before ordering, as required by TY0.01.

1.4 CLOSEOUT SUBMITTALS

- A. Provide record drawings, cable/device schedules, approved sequences, configuration backups, software/license information, operating manuals, maintenance instructions, test results, and warranty documents in Owner-approved electronic formats. Transfer administrative access securely to Owner.

1.5 QUALITY ASSURANCE

- A. Use a manufacturer-authorized or certified Installer experienced with the proposed system. Provide listed equipment suitable for its use; access-control units shall comply with UL 294. Comply with adopted NFPA 70 and applicable building, fire, egress, and accessibility requirements.

1.6 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate with County IT, existing alarm monitoring, door-hardware supplier, electrical and fire-alarm contractors before rough-in. Confirm system platform, credentials, workstation locations, network connections, power, equipment access, and scope responsibilities.
- B. Provide products rated for actual indoor or exterior temperature, humidity, moisture, and exposure. Resolve drawing and hardware conflicts before procurement; preserve required egress and fire-door operation.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Provide compatible, manufacturer-supported equipment and software sized for the indicated doors, users, inputs, outputs, and approved operating requirements. Include licenses and interfaces needed for a complete system compatible with the existing alarm monitoring system.

Coordinate manufacture with Escambia County IT department prior to creation of shop drawings.

- B. Management hardware and operating systems shall meet current manufacturer requirements and County IT policies. Coordinate dedicated or Owner-hosted computing resources and operator workstations; document license terms and recurring service requirements in submittals. Exact location of headend workstation owners prior to rough-in.

2.2 OPERATION

- A. Provide credential enrollment and revocation, access levels, door/time schedules, holidays, operator overrides, door-status display, alarm acknowledgment, and searchable event reports. Record access granted/denied, forced/held-open doors, tamper, communication failure, and power trouble with device identity and time.
- B. Controllers shall make local access decisions using stored permissions during host/network outages, retain events for subsequent upload, and report communication failures. Submit event-buffer capacity and recovery behavior for the approved system. Restore communications and synchronize records without losing buffered events within that capacity. Coordinate required offline even capacity or outage duration with owners prior to creation of shop drawings.
- C. Operate each door according to the approved sequence. Required egress and emergency release shall remain effective during access-control failures. Provide fire-alarm interfaces where required by the approved locking arrangement; do not rely solely on application software for required life-safety release.

2.3 APPLICATION SOFTWARE AND DATABASE

- A. Provide role-based operator permissions, unique accounts, audit trails, protected configuration and credential data, and scheduled backup/restore capability. Synchronize system time with a County IT-approved source. Retain events for Coordinate required retention duration with owners prior to creation of shop drawings.
- B. Use supported software/firmware and County IT-approved network security, authentication, encryption, and remote-access settings. Replace default credentials and disable unused services. Remote vendor access requires Owner authorization.

2.4 CONTROLLERS

- A. Provide intelligent controllers, compatible input/output modules, supervised monitoring circuits, and protected enclosures. Provide door-position and request-to-exit interfaces and relays rated for connected hardware. Annunciate enclosure tamper and circuit troubles appropriate to the selected listed system.
- B. Power Supplies: Provide dedicated, listed supplies and chargers compatible with controller, reader, and locking loads, including inrush and voltage drop. Provide eight-hour battery backup for all ACS components as required by TY0.01; coordinate backup for required management and network equipment.
- C. Monitor normal-power failure and battery trouble. Battery-backed power shall not defeat required door-release functions. Coordinate dedicated 120-V circuits with electrical work and door-hardware power supplies.

2.5 CARD READERS, CREDENTIAL CARDS, AND KEYPADS

- A. Provide readers and credentials compatible with the Owner-approved platform and credential format.
- B. Provide clear access-granted/denied indications and enclosures suitable for mounting and exposure. Coordinate reader communications and cable requirements with the selected system and County IT. Provide keypads only where indicated and coordinate enrollment with Owner.

2.6 DOOR HARDWARE AND RELEASE INTERFACES

- A. Coordinate electrified locks, door contacts, power transfers, request-to-exit devices, and manual release devices with the architectural door-hardware schedule. Provide compatible interfaces and complete connections; establish hardware supply responsibilities before procurement.
- B. Release devices and locking assemblies shall be listed and suitable for the approved door function, electrical load, egress arrangement, and fire rating. Do not impose one fail-safe or fail-secure arrangement on every door; follow the approved door sequence and applicable code requirements.

2.7 CABLES

- A. Provide manufacturer-approved copper cable with conductor size, pair count, shielding, and rating suitable for the interface, distance, load, and installation environment. Size lock-power circuits by voltage drop and operating/inrush loads. Provide plenum, riser, wet-location, and exterior ratings where applicable.
- B. Coordinate network cabling with Section 271500 and the two category-cable connections indicated at the ACP on TY0.01. Provide compatible surge protection for exposed power and signal circuits as recommended by the system manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify door/frame preparations, pathways, power, network, and equipment locations before installation. Hold the pre-rough-in coordination meeting required by TY0.01. Obtain approved door sequences, network settings, access schedules, and system configuration before programming.

3.2 CABLING AND INSTALLATION

- A. Install ACS signal wiring in end-to-end conduit from devices to junction boxes and panels as required by TY0.01; do not use cable tray or open wiring for these circuits. Coordinate with Section 270528 and security details. Conceal pathways where indicated and provide accessible junction boxes.
- B. Install to manufacturer instructions and approved shop drawings. Protect cables, maintain bend and pulling limits, and provide suitable terminations and service slack. Install supervision components at the monitored field devices as required by the listed system. Protect accessible equipment against tampering.
- C. Coordinate reader heights and clearances with Drawings and accessibility requirements. Complete hardware and fire-alarm interfaces without impairing door operation, required egress, or rated assemblies. Seal exterior penetrations and maintain rated penetrations using listed firestop systems.

3.3 GROUNDING AND BONDING

- A. Ground and bond equipment, enclosures, and metallic pathways in accordance with NFPA 70, ANSI/TIA-607-E, Section 270526, Drawings, and manufacturer instructions. Coordinate the ACP bonding connection shown on TY0.01. Terminate cable shields according to the selected interface requirements.
- B. Use the building grounding and bonding system; do not establish an isolated signal-ground electrode or disconnect required equipment grounding conductors.

3.4 IDENTIFICATION

- A. Provide durable machine-printed labels for cables at both ends, devices, panels, circuits, and terminals. Coordinate identifiers with door numbers, Owner requirements, and ANSI/TIA-606-D. Match labels to record drawings, configuration, and test reports.

3.5 PROGRAMMING AND STARTUP

- A. Load approved door sequences, access levels, schedules, alarms, and reporting. Verify licenses, operator permissions, backup/restore, time synchronization, and monitoring interfaces. Enroll Owner-designated credentials and provide a final configuration backup.

3.6 FIELD QUALITY CONTROL

- A. Use qualified personnel and manufacturer support to inspect and test every controlled opening, device, circuit, and interface. Verify wiring, listings, labeling, supervision, grounding, power-supply loading, and voltage at connected loads. Certify network cabling under Section 271500.
- B. Demonstrate valid/invalid credentials, schedules, manual commands, door-position and request-to-exit operation, forced/held-open alarms, tamper, and monitoring reports. Test communication loss, local operation, event buffering/upload, power failure/restoration, and battery trouble.
- C. Verify eight-hour backup using the approved load calculations and documented discharge testing under representative connected loads. Coordinate outages with Owner. Witness door-specific fire-alarm release, emergency/manual release, loss-of-power behavior, and reset with hardware and fire-alarm trades.
- D. Submit results by door/device and test condition, including measured values, acceptance criteria, deficiencies, corrections, and final settings. Correct failures and retest affected functions before acceptance.

3.7 PROTECTION

- A. Protect equipment, credentials, and system data during installation. Maintain required building security and egress during cutover; coordinate interruptions with Owner. Remove temporary accounts and transfer administrative control at turnover.

3.8 DEMONSTRATION

- A. Train Owner personnel in credential management, schedules, alarm response, reports, backup/restore, routine maintenance, and support procedures. Demonstrate the approved door sequences and deliver training records and final operating information.

END OF SECTION 281300

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Remote annunciator.
6. Addressable interface device.

B. Related Requirements:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Locate detectors according to manufacturer's written recommendations.

12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal and Shop Drawing Requirements:
 1. Submittals shall be approved by authorities having jurisdiction prior to commencing construction.
 2. The contractor will provide the design drawings as part of this effort. The drawings shall be submitted for AHJ approval.
 3. Shop Drawings shall be prepared by a minimum NICET Level III who is licensed in the State of Florida and has relevant experience. The shop drawings shall comply with the State requirements for the facility.
- D. Delegated-Design Submittal: For notification appliances and any smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed by the qualified NICET responsible for their preparation.
 1. Drawings showing the location of each notification appliance and any smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment.
 - d. Riser diagram.
 - e. Record copy of site-specific software.
 - f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

- 1) Equipment tested.
- 2) Frequency of testing of installed components.
- 3) Frequency of inspection of installed components.
- 4) Requirements and recommendations related to results of maintenance.
- 5) Manufacturer's user training manuals.

- g. Manufacturer's required maintenance related to system warranty requirements.
- h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.
- F. NFPA Certification: Obtain certification according to NFPA 72.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and speaker/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Carbon monoxide detectors.
 - 6. Automatic sprinkler system water flow.
 - 7. Fire-extinguishing system operation.
 - 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 8. Activate preaction system.
 - 9. Recall elevators to primary or alternate recall floors.
 - 10. Activate elevator power shunt trip.
 - 11. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
 - 3. Elevator shunt-trip supervision.
 - 4. Loss of communication with any panel on the network.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
 2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
 3. After a time delay of 200 seconds transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B.
 2. Pathway Survivability: Level 0
- D. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or

- 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
- a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
- a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
6. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F
 - c. Multiple levels of detection sensitivity for each sensor.
 - d. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

- a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Speaker: Provide field selectable watt taps. Optimized for voice intelligibility. 25 VRMS or 20 VRMS compatible with the fire alarm system. Comply with UL 464.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 1. Mounting: Wall mounted unless otherwise indicated.
 2. Flashing shall be in a temporal pattern, synchronized with other units.

3. Strobe Leads: Factory connected to screw terminals.
4. Mounting Faceplate: Factory finished, red.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. General:
 1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown
 1. Allow the control panel to switch the relay contacts on command.
 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 1. Operate notification devices.
 2. Operate solenoids for use in sprinkler service.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor.

- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
- H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install speakers on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- L. Visible Alarm-Indicating Devices: Install adjacent to each alarm speaker and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

- A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 1. Smoke dampers in air ducts of designated HVAC duct systems.
 2. Magnetically held-open doors.
 3. Electronically locked doors and access gates.
 4. Alarm-initiating connection to elevator recall system and components.
 5. Alarm-initiating connection to activate emergency lighting control.
 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 7. Supervisory connections at valve supervisory switches.
 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 9. Supervisory connections at elevator shunt-trip breaker.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (latest edition).
- C. Florida Stormwater, Erosion, and Sedimentation Control Inspection manual (latest edition).

1.02 SUMMARY

- A. Section Includes:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and removing site utilities.
 - 7. Temporary erosion- and sedimentation-control measures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
 - 3. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
 - 4. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.03 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: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than

2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. 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.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 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.

1.05 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 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 utility locator service for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- D. 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.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify clearing limits.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 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 a sediment and erosion control plan, specific to the site that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. General: Employ erosion control management practices as required by the General Permit for Storm Water Discharges. The Contractor is responsible for transferring the NPDES Permit for construction activity. The current permit is held by the Owner. The Contractor will be responsible for application and maintenance of all conditions required by the Permit. Submit name of the Professional Engineer and/or Engineering firm to the Architect that is to be responsible for oversight of all requirements of the NPDES Permit until acceptance of all work under this Contract. The Owner or others working under the direction of the Owner may be working on this site during this Contract. Work by others will not relieve the Contractor of complying with all requirements of the NPDES Permit.
- C. Control and abate water pollution and erosion at its potential source; employ downstream sediment entrapment measures as a backup to primary control at the source.

- D. Take all reasonable precautions to prevent and suppress fires and other detrimental occurrences which may be caused by construction operations.
- E. Straw wattles shall be anchored by use of stakes.
- F. Once installed, maintain silt fence until its capacity has been reached or erosion activity in the areas has been stabilized. When a silt fence has reached its capacity to function and need for a backup fence becomes evident, provide an additional line of silt fences. Repair of a damaged silt fence shall be accomplished by utilizing same type of materials used in original construction.
- G. Remove erosion and sedimentation controls once areas have been stabilized. Restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site against damage during construction by installation of orange construction fence around tree save areas where applicable.
- B. 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.

3.04 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Program Manager not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Program Manager's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Remove roots, stumps, obstructions, and debris to a depth of 24" below exposed subgrade.
 - 3. 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 98% density according to ASTM D 698.

3.06 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil 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 slope of topsoil stockpiles to 3 horizontal and 1 vertical.
 - 2. Do not stockpile topsoil within protection zones.

3.07 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 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. Any remaining foundations, slabs or piping shall be disposed of in accordance with Section 01 74 19 Construction Waste Management and Disposal.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Reports of Subsurface Exploration and Geotechnical Evaluation, by NOVA Engineering and Environmental LLC (NOVA), project no. 10116-2025264, and provided as supplement to the Project Manual
- B. 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. 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, pavements.
 - 5. Subbase course and base course for asphalt paving.
 - 6. Subsurface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for recording pre-excavation and earth moving progress.
 - 2. Division 01 Sections "Allowances" and "Unit Prices"
 - 3. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
 - 4. Divisions 22, 26, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
 - 5. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

1.3 UNIT PRICES

- A. A. All excavation to be unclassified. This shall include, but not limit to the following:
 - 1. Balancing the earthwork with on-site material

2. Striping of topsoil, re-plating slopes, and stockpiling for future use in locations shown on drawings.
 3. Grubbing
 4. Mass excavations – soil and rock
 5. Utility trench excavations – soil and rock
 6. Undercutting of loose soils, moisture conditioning & recompacting.
 7. Over excavation of rock within the building pad, parking lots, roadways, ballfield areas, and trenches and replaced with compacted engineered fill from an on-site source.
 8. Overfilling and cutting back fill slopes
 9. Moisture conditioning & re-compacting the on-site soils for suitable placement as engineered fill
 10. Re-conditioning of previously compacted areas when soils get wet prior to acceptance and/or turning over of area to the owner.
 11. Subsurface drainage in drainage swales.
 12. Installation and monitoring of settlement monitoring plates.
 13. Keying in/benching fill slopes into existing grade.
- B. However, all undercut of loose soils, moisture conditioning & replacement below the “cut line” will be handled with a quantity allowance with unit price being provided on the bid proposal form to be included in the base bid. The bid proposal form will have unit prices for the undercutting of loose soils, moisture conditioning and replacing with compaction per the specifications.
- C. The measurement process for all quantity allowance amounts shall be the initial responsibility of the contractor. The basis for measurement will be based on a before and after cross section survey of the area in question. No truck counts will be allowed. Measurements will be verified by the Owner’s on-site Geotechnical Engineer.

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 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.
- 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 and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- 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.
- L. Cut Line: In a cut section, the cut line shall be defined as subgrade elevation or elevation required by other specified hold down, over excavation, trench excavation, etc. In a fill section, the cut line shall be defined as the elevation achieved upon completion of all topsoil stripping, grubbing operations, etc. as approved by the owner's onsite geotechnical engineer prior to placing fill material.

1.5 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
 2. Controlled low-strength material, including design mixture.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
 2. Laboratory compaction curve according to ASTM D 698.
- C. Blasting Plan: For record purposes; approved by authorities having jurisdiction.
- D. Seismic Survey Report: For record purposes; from seismic survey agency (i.e., pre-blast survey).
- E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be

misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

- F. Rock management plan.
- G. As-built topographic survey on a foot contour interval with spot elevations at breakpoints and at structures in Autocad DWG format shall be submitted to the Architect prior to acceptance of areas.
- H. Settlement plate monitoring data for vertical movement of deep fill slopes.

1.6 QUALITY ASSURANCE

- A. Blasting: Comply with all applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
 - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 and ASTM D 3740 for testing indicated. The independent testing agency shall be provided by the owner.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations to locate all existing utilities.
- C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing," are in place.

- D. Do not commence earth moving operations until plant-protection measures are in place.
- E. 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.
- F. Do not direct vehicle or equipment exhaust towards protection zones.
- G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GC, GM, MH (below 3 feet of structures and 1 foot of pavement or ballfields), ML, CL, SC, SW, SP, and SM according to ASTM D 2487, 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.
 - 1. Liquid Limit: Less than 50.
 - 2. Plasticity Index: Less than 25.
 - 3. Maximum dry density: > 100 pcf.
- C. Unsatisfactory or Unsuitable Soils: Soil Classification Groups OL, CH, MH (within upper 3 feet of structures or 1 foot of pavements or ballfields), OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 3 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.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - 4. Tear Strength: 90 lbf; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. 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 EXPLOSIVES – Not Used

3.4 EXCAVATION, GENERAL

- A. All excavation on this project is unclassified regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
- B. Material encountered in grading operations that, in the opinion of the Geotechnical Engineer, is unsuitable or undesirable shall be as follows:
 - 1. The removal of unsuitable material will be directed by the onsite Geotechnical Engineer. All unsuitable material that is removed by the Contractor shall become the property of the Contractor and disposed of offsite or in a manner satisfactory to the Owner at no additional cost. All ground modifications in the upper 24 inches from existing grade shall be included in the base bid.
 - 2. Backfill for these areas will be with material approved by the Geotechnical Engineer, with layers of acceptable material compacted to the requirements set forth in these specifications.
 - 3.
- C. The Contractor shall be responsible for removing overshot/overbroken/disturbed rock and replacing with the appropriate material such as flowable fill, lean concrete, or systematically compacted crushed stone at the direction of the Geotechnical Engineer at no additional cost.
- D. Undercutting and replacement of loose soils may be required to the underlying stiff soils. All undercut and replacement shall be handled in accordance with 1.3 Unit Prices B. above for material below 24 inches from existing grade.
- E. Keying in/benching required to construct non-reinforced slopes to tie into the natural embankment and the consequent removal of unsuitable soils with such benching/keying is "base bid" work and not a part of the undercut of unsuitable soils allowance.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- 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.

- C. Where rock is encountered, the "cut line" shall be a minimum of 4 feet below the proposed subgrade and suitable material replaced to the proposed subgrade to create a soil cap.

3.6 EXCAVATION FOR WALKS, PAVEMENTS AND BALLFIELDS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Where rock is encountered, the "cut line" shall be a minimum of 2 feet below the proposed subgrade and suitable material replaced to the proposed subgrade.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: As indicated.
- 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. Where rock is encountered, the "cut line" shall be a minimum of 6 inches below the proposed subgrade and suitable material replaced to the proposed subgrade.
 - 5. Where unsuitable soil is encountered, the "cut line" shall be a minimum of 6 inches below the proposed subgrade and suitable material replaced to the proposed subgrade.
- D. Trench Bottoms: Excavate trenches 4 to 6 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.
- E. Trenches in Tree- and Plant-Protection Zones:
 - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose

- roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade 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. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.
- F. An As-built survey must be provided as proof of compliance with Section 3.16 B. below. Contractor shall note that the Owner's building general contractor may occupy the site prior to the completion of this contract and phased turnover of areas may be required for the building pad and parking lots and shall be accounted for in the base bid.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect and Geotechnical Engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. For storm utility drainage piping place 4" of #57 stone bedding for pipes less than 36" in diameter and 6" of #57 stone bedding for pipes 36" in diameter and greater. Backfill with satisfactory soils.
- 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 Division 03 Section "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to the top of utility pipe or utility conduit, with the exception of storm utility drainage piping.
 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.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit with the exception of storm utility drainage piping. Coordinate backfilling with utilities testing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

- H. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use satisfactory soil material.
 - 4. Under building slabs, use satisfactory soil material.
 - 5. Under footings and foundations, use satisfactory soil material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.
- D. Fill slopes shall be constructed from the bottom up in horizontal lifts, overfilled and then cut back to the planned slope limits so that the entire slope mass (including the slope face) is uniformly compacted with a consistent, uniform slope face.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- 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 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade at 95% and each layer of backfill or fill soil material up to finished subgrade level with the expectation being the upper 12" below structure foundations and

structure slabs-on-grade in which case compaction shall meet or exceed 98%.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under 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. Compact upper 2 ft to 95 %.
4. For utility trenches, compact each layer of backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site 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.

3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: As specified on drawings.
- 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 with a minimum of two passes of a plate-type vibratory compactor.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.
 2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape base course to required crown elevations and cross-slope grades.
 - 4. Place base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

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 independent 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 if approved by Architect and Geotechnical Engineer.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2937, and ASTM D 6938, 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.
- G. Settlement plates shall be monitored for vertical movement of deep fill areas with data to be provided to the Civil Engineer, Geotechnical Engineer, and the Architect for review. Monitoring shall last a minimum of 30 days. After such time additional monitoring may be required until stability of the fill mass has been achieved. Note that the owner's on-site geotechnical engineer will be the final authority on whether an area is stabilized and building construction can commence.

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.
- D. Settlement plates shall be protected against damage to assure an accurate and reliable data source.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory topsoil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

**SECTION 313116
TERMITE CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.
- B. Section 07 2616 - Integrally-Bonded Underslab Vapor Retarder.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
- C. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2022.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- D. Test Reports: Indicate regulatory agency approval reports when required.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- G. Manufacturer's Instructions: Indicate caution requirement.
- H. Record and document moisture content of soil before application.
- I. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
- J. Maintenance Data: Indicate re-treatment schedule .
- K. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
 - 2. Inspect annually and report in writing to Owner. Provide inspection service for five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:
 - 1. Bayer Environmental Science Corp; ____: www.backedbybayer.com/pest-management/#sle.
 - 2. FMC Professional Solutions; ____: www.fmcprosolutions.com/#sle.
 - 3. Syngenta Professional Products; ____: www.syngentaprofessionalproducts.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- D. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. **New Community Center**
 - 2. Under Slabs-on-Grade.
 - 3. Under Slabs below grade.
 - 4. At Exterior Side of Foundation Surface.
 - 5. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of ____ feet (____ m).
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. FDOT Standard Specification for Road and Bridge Construction, latest edition.

1.02 SUMMARY

- A. Section Includes:

- 1. Cold milling of existing hot-mix asphalt pavement.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt paving.
 - 4. Hot-mix asphalt paving overlay.
 - 5. Asphalt surface treatments.
 - 6. Pavement-marking paint.

- B. Related Sections:

- 1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
 - 2. Division 32 Sections for other paving installed in asphalt pavement areas.

1.03 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. FDOT: Florida Department of Transportation.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Submit documentation of recycled content from manufacturer for products with specified recycled content.
- D. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of building site.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
- C. Regulatory Requirements: Comply with FDOT's "Standard Specifications for Road and Bridge Construction", latest edition for asphalt paving work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 40 deg F.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: Shall comply with FDOT specification section 901.
- C. Fine Aggregate: Shall comply with FDOT specification section 902.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: Shall comply with FDOT specification section 917.

2.02 ASPHALT MATERIALS

- A. Asphalt Concrete: Per FDOT SP-9.5. Specification Section 334 and 320.
- B. Prime Coat: Per FDOT specification section 300.
- C. Tack Coat: Per FDOT specification section 300.
- D. Water: Potable.

2.03 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073, Grade Nos. 2 or 3.
- C. Joint Sealant: ASTM D 6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952.
 - 1. Color: As indicated.

2.04 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes meeting the requirements of the applicable sections of FDOT "Standard Specifications for Road and Bridge Construction" and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 2 inches.
 - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 - 3. Control rate of milling to prevent tearing of existing asphalt course.
 - 4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
 - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 - 6. Keep milled pavement surface free of loose material and dust.

3.03 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.04 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.05 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.06 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.07 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.08 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.09 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.

- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.010 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 15 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.011 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.012 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure transition couplings.
 - 3. Cleanouts.
 - 4. Drains.
 - 5. Manholes.
 - 6. Channel drainage systems.
 - 7. Catch basins.
 - 8. Stormwater inlets.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 - 2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

1.03 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.

1.04 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 Program Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Program Manager's written permission.

PART 2 - PRODUCTS

2.01 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

- A. Pipe: ASTM A 716, for push-on joints.
- B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
- C. Compact Fittings: AWWA C153, for push-on joints.
- D. Gaskets: AWWA C111, rubber.

2.02 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

- A. Mechanical-Joint Piping:
 - 1. Pipe: AWWA C151, with bolt holes in bell.
 - 2. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
 - 3. Compact Fittings: AWWA C153, with bolt holes in bells.
 - 4. Glands: Cast or ductile iron, with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
 - 5. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

2.03 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.
- B. Corrugated PE Pipe and Fittings NPS 12 to NPS 15: 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.

2.04 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
 - 1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets
 - 2. Class III, Wall B.

2.05 CLEANOUTS

- A. Cast-Iron Cleanouts:
 - 1. 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.
 - 2. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
 - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.06 DRAINS

A. Cast-Iron Area Drains:

1. Description: ASME A112.6.3 gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
2. Top-Loading Classification(s): Medium and Heavy Duty.

2.07 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 5-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 5-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: Individual Polypropylene steps with steel reinforcement, 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 16-inch intervals. At least one step is required per manhole.
10. 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: Individual Polypropylene steps with steel reinforcement, 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 16-inch intervals. At least one step is required per manhole.
6. 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: Cast Iron; 24-inch ID by 6-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 48, Class 35 gray iron unless otherwise indicated.

2.08 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: 3000 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, 3000 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 one-half 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.

2.09 GRATE INLETS

- 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 5-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 3. Riser Sections: 5-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. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
 7. Steps: Individual FRP steps or FRP ladder, 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. At least one step is required per manhole.
 8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 30 by 30 inches minimum unless otherwise indicated.
 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.010 STORMWATER INLETS

- A. Curb Inlets: Made with vertical curb opening.
- B. Gutter Inlets: Made with horizontal gutter opening. Include heavy-duty frames and grates.
- C. Combination Inlets: Made with vertical curb and horizontal gutter openings. Include heavy-duty frames and grates.
- D. Frames and Grates: Heavy duty.

2.011 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: FDOT 12" size
- C. Filter Stone: FDOT #57.
- 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

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 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 with 36-inch minimum cover.
 - 3. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - 4. Install PE corrugated sewer piping according to ASTM D 2321.
 - 5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - 2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - 3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 - 4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 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.

3.05 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.

3.06 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.

3.07 GRATE INLET INSTALLATION

- A. Construct grate inlets to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.08 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.

3.09 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.010 CHANNEL DRAINAGE SYSTEM INSTALLATION

- A. Install with top surfaces of components, except piping, flush with finished surface.
- B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

- C. Embed channel sections and drainage specialties in 5-inch minimum concrete around bottom and sides.
- D. Fasten grates to channel sections if indicated.
- E. Assemble channel sections with flanged or interlocking joints.
- F. Embed channel sections in 6-inch minimum concrete around bottom and sides.

3.011 CONNECTIONS

- A. 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.

3.012 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.013 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.014 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: 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.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.015 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION