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## CONTRACT DOCUMENTS

October 31, 2025

TOWN OF  
**Truro**  
MASSACHUSETTS

New Department of Public Works Facility  
17 Town Hall Road  
Truro, MA 02666

W&S PROJECT No.: ENG24-1552

## Volume II

Divisions 02 through 22

Issued for Design Development

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| <del>Section 32 32 23.13</del> | <del>Segmental Retaining Wall System</del>             |
| Section 32 91 19               | Loaming & Seeding                                      |
| <del>Section 32 93 00</del>    | <del>Trees, Shrubs, Groundcovers and Landscaping</del> |

### **DIVISION 33 — UTILITIES**

|                                |                                                        |
|--------------------------------|--------------------------------------------------------|
| Section 33 05 26.13            | Tracer Tape                                            |
| Section 33 11 13.13            | Ductile Iron Pipe and Fittings for Water Mains         |
| <del>Section 33 11 13.28</del> | <del>HDPE Pipe</del>                                   |
| Section 33 11 13.43            | Insulation for Pipelines                               |
| Section 33 12 22               | Hydrants and Valves for Potable Water Work             |
| <del>Section 33 16 56</del>    | <del>Ground Level Plastic Water Storage Cisterns</del> |
| <b>Section 33 23 13</b>        | <b>Geothermal Closed Loop Wells</b>                    |
| Section 33 31 13.16            | Polyvinyl Chloride Gravity Pipe and Fittings           |
| Section 33 31 13.46            | Connections to Existing Structures                     |
| <del>Section 33 32 16.25</del> | <del>Grinder Pump Units</del>                          |
| <del>Section 33 34 00</del>    | <del>On Site Wastewater Disposal</del>                 |
| Section 33 39 13               | Precast Manholes and Catch Basins                      |
| <del>Section 33 41 13</del>    | <del>Reinforced Concrete Pipe</del>                    |
| <del>Section 33 41 13.16</del> | <del>Polyethylene Drainage Pipe (Perforated)</del>     |
| Section 33 41 13.22            | Corrugated Polyethylene (HDPE) Drainage Pipe           |
| Section 33 44 26               | Underground Stormwater Chamber System                  |
| <b>Section 33 71 19</b>        | <b>Geothermal</b>                                      |

--- END OF TABLE ---

## SECTION 02 41 16

### STRUCTURE DEMOLITION

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION:

A. This Section specifies the demolition of the former **Department of Public Works Facility Buildings, 17 Town Hall Road, Truro, Massachusetts** at the location shown on **Drawing C201: Demolition Plan**. This demolition work is located within the Contract Limits of Work as shown on the Site Demolition Plan and as specified in Section 01014, SCOPE AND SEQUENCE OF WORK. The extent of building demolition work includes the removal and proper disposal of all **aboveground structures, and substructures in their entirety, except for the Fuel Island Facility**, unless otherwise specified. The CONTRACTOR shall verify the construction and condition information of each of the buildings as well as the information presented in these Contract Documents, by site inspection, and shall provide all resources to perform the building demolition work.

##### B. Extent of Physical Building Demolition

1. The **DPW** structures shall be removed in their entirety inclusive of all above and below grade structures. All utilities and equipment within each building footprint shall be removed from the site as property of the CONTRACTOR. Utility services to the building shall be disconnected/terminated/abandoned in accordance with **Drawing C201: Demolition Plan**. Any live utility feeds to the building must be terminated in accordance with the utility owner.
2. As part of Building Demolition, the CONTRACTOR shall remove and dispose of properly any furnishings, fixtures, equipment, mechanical aspects, and any and all other structural and non-structural improvements and aspects. CONTRACTOR to coordinate with EQ Series drawings for Industrial Equipment to be saved for reuse and reinstallation in the New DPW Facility. CONTRACTOR should assume that furnishings that may have been observed by it during the pre-bid site inspection will become its property and shall be removed and properly disposed of by the CONTRACTOR, unless specifically identified to the contrary in these Contract Documents or as required by the ENGINEER. All materials, both hazardous and non-hazardous, shall be removed, reused and/or transported to appropriate disposal facilities.
3. Any pipes or other hollow structures within the building footprint shall be removed.
4. Any fill materials under slabs, but above surrounding grade within a building's or structure's footprint, shall be removed to the extent necessary to level the footprint area to the ground lines immediately outside the footprint and shall be graded such



that no storm water ponding shall occur. Such above ground fill shall be kept on site and spread or stockpiled as required by the ENGINEER.

5. The CONTRACTOR shall demolish and remove all additional structural or non-structural portions of the buildings as is required for complete removal of the buildings from the site as described above. This shall include all stairs, porches, platforms and other improvements associated with the buildings and other structures, even though they may be located or extend beyond the buildings or structures general footprint.
6. In areas where demolition work is performed, protect, support, secure, and maintain both underground and aboveground utility systems that are to remain. Use support of excavation and dewatering techniques as specified in Section 31 50 00 – SUPPORT OF EXCAVATION and Section 31 23 19 – DEWATERING.
7. The CONTRACTOR shall be prepared at all times to assist the ENGINEER in the collection of soil and water samples during demolition activities.

#### C. Demolition Outside the Building Footprints

1. Remove and dispose of all interior fencing, poles, overhead utilities, debris, site appurtenances and improvements unless otherwise noted herein or required by the ENGINEER. The CONTRACTOR shall visually inspect the site outside of the buildings' footprints for verification and completeness of site appurtenances, improvements, amenities that are to be removed and disposed.
2. Refer to **Drawing C201: Demolition Plan** for paved surfaces and other pre-demolition surface treatments to remain or to be demolished to achieve the work under this Contract. The CONTRACTOR shall not remove other paved areas until, and if, it is required to complete the scope of the project as portrait in the design documents and to do so after consulting with the ENGINEER.
3. All utilities outside of the building footprints are to be abandoned in place unless otherwise noted in the Contract Documents.
4. All other above-grade and at-grade manmade improvements, including **flagpoles, signs, retaining walls, curbs, pavers, planters**, and similar, and any associated foundations shall be removed in their entirety.
5. The site shall be left in neat and safe condition leveled to existing grades outside the demolished buildings' footprint.

#### 1.02 REGULATORY REQUIREMENTS:

- A. Conform to applicable codes and requirements for demolition of structures, safety of adjacent structures, dust control, service utilities, and discovered hazards.

- B. Dispose or recycle all demolition debris in accordance with all applicable regulations.
- C. **CONTRACTOR shall be aware that existing structures are painted with lead paint. Hence, demolition of the structures shall comply with all applicable lead paint regulations. CONTRACTOR performing this work shall be thoroughly knowledgeable of all federal, state and local laws, rules, and regulations regarding materials containing or coated with lead or lead products. By bidding this Contract, the CONTRACTOR is stating its expertise in this work and the Town of Truro shall not be responsible for any additional costs incurred by the CONTRACTOR as a result of any misunderstanding or disagreement with the applicable federal, state, and local laws, rules, and codes. Refer to Section 02 83 19 for additional requirements.**
- D. **Collection, treatment, and disposal of all lead-containing wastes shall be in strict accordance with current applicable federal, state, and local laws, rules, and codes, including, but not limited to, Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Act (OSHA), and USEPA. Refer to Section 02 83 19 for additional requirements.**

#### 1.03 DESCRIPTION OF BUILDINGS

The following is a general description of the building to be demolished. The description is not complete and is provided only for the assistance of the CONTRACTOR. Details regarding the structures size and construction are not guaranteed to be correct and the CONTRACTOR shall not be able to make a claim based on their correctness. The CONTRACTOR shall visually inspect for verification, quantification, and completeness of the building's structural and non-structural systems to be demolished and removed, as well as the building's contents for removal and disposal.

- 1. **To be demolished are all Buildings and Sheds associated with the Existing Department of Public Works except for the Existing Fuel Island which is to remain intact and in operation before, during and after construction of the New Department of Public Works has been completed.**

#### 1.04 RELATED WORK:

- A. Due to the nature of the work described in this Section, the CONTRACTOR shall examine the Contract Documents thoroughly for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to, those listed below.
- B. Section 00 31 43 -- PERMITS
- C. Section 01 12 16 – SCOPE AND SEQUENCE OF WORK
- D. Section 01 14 19.25 – DUST CONTROL

- E. Section 01 35 29 – HEALTH AND SAFETY PLAN
- F. Section 01 52 13 – TEMPORARY FACILITIES
- G. Section 01 55 26.13 – TRAFFIC CONTROL
- H. Section 01 57 19 – ENVIRONMENTAL PROTECTION
- I. Section 02 83 19 – LEAD BASED COATINGS REMOVAL**
- J. Section 31 00 00 – EARTHWORK

1.04 SUBMITTALS:

- A. Permits and Certificates: Submit permits and certificates to the Engineer prior to start of demolition work; coordinate with the requirements of Section 00 31 43 - PERMITS. Items to be submitted include but are not limited to the following:
  - 1. Permits and notices authorizing building demolition.
  - 2. Certificates of severance of utility services.
- B. Lead Compliance Plan: Prior to the start of demolition work, and no later than 15 calendar days after the date of the Notice to Proceed, submit a site-specific Lead Compliance Plan in accordance with OSHA Lead in Construction Standard 1926.62 that identifies all lead hazards and proper work procedures for the work of this section, and includes the required items listed below. This plan shall remain on file at the project site and be updated throughout the work as conditions warrant. Coordinate plan with the requirements of Section 02 83 19 – LEAD BASED COATINGS REMOVAL.**
  - 1. Employer’s Hazard Communication Program, Worker “Right-to-Know”, as identified by OSHA 1910.1200 HAZCOM.**
  - 2. Respiratory Protection Program including proper medical monitoring and respiratory protection program requirements, as required by 1926.62 and DLI regulations at 454 CMR 22.11, as currently amended.**
  - 3. Written description and acceptance, of all proposed procedures, methods, or equipment to be utilized. In all instances, CONTRACTOR must comply with all applicable federal, state and local regulations.**
  - 4. Proposed worker training and orientation plan which at a minimum includes a description of hazards and remediation methodologies, a review of worker protection requirements, proposed decontamination procedures, and location of wash stations and change areas.**

**5. The name and address of personal air monitoring laboratory(s) performing testing required by these Specifications and applicable regulations.**

C. Demolition Plan: Prior to the start of demolition work, and no later than 30 calendar days after the date of the Notice to Proceed, submit a comprehensive Demolition Plan, stamped and signed by a Professional Engineer registered in the **Commonwealth of Massachusetts**, for the ENGINEER's review and approval prior to demolition work. The Demolition Plan shall be coordinated with, and as appropriate include reference to, the various plans and submittals required by these Specifications. At a minimum the CONTRACTOR's Demolition Plan shall specifically include and address the following.

1. A schedule that details the sequence of demolition both for the sequence of work within a building and for the overall sequence for the buildings being demolished under this Contract.
2. Methods, equipment and operations. Include information such as catchment system protection details and procedures, equipment types and placement, name and address of all demolition debris transporters, and protection controls, including protection to traffic, passersby, and abutting parcels.
3. Coordination for shut-off, capping, and continuation of utility services as required.
4. A site plan indicating CONTRACTOR's intended plan and identifying location for various aspects such as temporary demolition staging and stockpiling areas, debris storage areas, dumpster locations, truck loading areas, equipment and material storage, temporary sanitary facilities, employee parking and similar information.
5. Layout and phasing of the required construction fencing.
6. CONTRACTOR shall identify and make arrangements with all off-site reuse, recycling, and disposal facilities to be used. The CONTRACTOR shall not remove any materials from the site until its Demolition Plan has been approved by the ENGINEER. The CONTRACTOR shall not remove any demolition material to any off-site facility or location not listed in its approved Demolition Plan. If, following approval of the Demolition Plan, the CONTRACTOR desires or identifies a need to use any facility not included in the Plan, it must submit all the information as required by this paragraph, and receive approval for same, prior to such use. The Demolition Plan shall, at a minimum, contain the following:
  - Disposal facility name(s).
  - Disposal facility address(es).
  - Name and title of contact person for each disposal facility to be used.

- Telephone number of contact person for each disposal facility to be used.
- For each disposal facility to be used, copies of licenses or permits to operate and confirmation that they are permitted to accept demolition materials to be taken to that facility.
- Lists matching each facility with the materials it will accept for this project, and specifying whether the facility is a treatment, storage, or disposal facility.
- Confirmation from the facility(ies) that they will accept the type and quantities demolition materials.
- Description of CONTRACTOR's procedures to manage and track materials and example of CONTRACTOR's material tracking log.

D. Shop Drawings: Submit shop drawings, stamped and signed by a Professional Engineer registered in the **Commonwealth of Massachusetts**, for the ENGINEER's review and approval at least four weeks prior to the associated demolition work. Each submittal shall include the reference to the Specification Section(s) and relative paragraph(s) being addressed in the submittal. At a minimum, shop drawings shall be submitted for the following and shall address the aspects identified.

1. Temporary structural supports as required during demolition, including but not limited to, scaffolding, bulk heads for buildings severed by the property line, and any other protective structures. Particular attention shall be given to fall hazards.
2. Calculations for floor loading adequacy to support any equipment that the Contractor will have on any of the building floors during any phase of demolition.
3. Competent person to supervise the erection and dismantling of scaffold on-site.
4. Requirements and procedures for assuring trained and experienced workers.
5. Inspection and tagging program.
6. Drawings of engineered fall arrest systems designed by a professional engineer.
7. Utilization of completely decked working levels for the handling of materials.
8. Identification of prohibited activities, e.g. prohibition of the use of cross bracing as a working surface, climbing device or as handrails, etc.
9. Limitations of work during adverse weather conditions.
10. Provisions that only scaffold grade planking or equivalent be used.

11. Methods of temporary protection for the poles, overhead wires, and pole-mounted transformers on site, when, and if, applicable. These shop drawing submittals shall include a copy of the written approval from the electrical utility company and other affected overhead utility authorities, for the proposed protection of their overhead utility system. This protection system must clearly show that this utility service is adequately protected, and that worker and public safety is ensured in providing utility protection and performing the work of this Section.
  12. Methods, equipment, and sequence of operations for the demolition of each building showing how the public is protected during such demolition.
  13. Methods, equipment and materials being used for any support of excavation for the protection of utilities and adjacent structures.
  14. Methods of demolition of a building that show how adjacent property is being protected, if necessary.
- E. Subsurface Location Survey: Where any portion of a disconnected service remains following demolition (only as approved by the ENGINEER), submit a Mylar and six copies of a survey plan that identifies remaining subsurface conditions. The survey shall be shown on an as-built record plan, signed and stamped by a registered land surveyor who is licensed in the **Commonwealth of Massachusetts**.
- F. Submit to the ENGINEER a copy of any sampling analyses within 2 days of receipt of the laboratory reports for the sampling. Analytical data shall be kept confidential, distributed only to the ENGINEER and as necessary, **DEP**.
- G. Disposal Receipts: Prior to submission of a periodic invoice for payment for Work including materials disposal, and within 21 days of transportation from the site, the CONTRACTOR shall document actual disposal of the waste at the designated landfill by completing an associated Disposal Certificate and submitting the original to the ENGINEER together with all associated disposal receipts from the solid waste facility or the recycling site. Such certificates and receipts shall bear the printed name of the facility operator and shall specify the date of delivery; the quantity and type of material delivered, and shall be signed by an on-site representative of the facility operator. Payment may be withheld at the discretion of the ENGINEER for the disposal of materials for which there are no signed disposal receipts.
- 1.05 JOB SITE CONDITIONS:
- A. The CONTRACTOR shall become thoroughly familiar with the site and of existing utilities and their connections, and within 15 calendar days of the Notice to Proceed for this demolition Contract, note all conditions that may influence the work of this Section.

## 1.06 LEAD BASED PAINT CONSIDERATIONS

**Refer to Section 02 83 19 for lead based paint considerations.**

#### 1.07 PROTECTION AND CONTROLS:

- A. The CONTRACTOR shall keep in service existing utilities that are not being discontinued by the work of this Contract and shall protect them against damage during demolition operations. Do not interrupt existing utilities servicing occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Perform all work in compliance with 29 CFR 1910.333 and 29 CFR 1926.955. Coordinate with the requirements of Section 01 11 00 – CONTROL OF WORK AND MATERIALS.
- B. CONTRACTOR shall arrange and pay for disconnecting, removing, capping, and plugging utility services. Utility services disconnected at underground mains shall be repaired in accordance with the requirements of the affected utility company. Place markers to indicate location of disconnected services and indicate such locations on the Subsurface Location Survey required in this Section. Coordinate with the requirements of Section 00 31 43 - PERMITS.
- C. The CONTRACTOR shall actively relocate construction fencing as necessary and appropriate to correspond to ongoing demolition operations.
- D. CONTRACTOR shall perform its operations in such a manner, including any necessary support of excavation and dewatering as specified in the Contract Documents, as to prevent movement or settlement of adjacent structures, or movement, settlement, or collapse of adjacent services and sidewalks. Cease operations and notify the ENGINEER immediately if safety of adjacent structures or services appear to be endangered. Do not resume operations until safety is restored. CONTRACTOR shall be solely responsible and liable for any such movement, settlement, damage, or injury due to its operations. Promptly repair damage at no cost to the OWNER. Coordinate with the requirements of Section 01 11 00 - CONTROL OF WORK AND MATERIALS.
- E. CONTRACTOR shall ensure safe passage of persons around areas of demolition. Provide, erect, and maintain steel boarding, sidewalk shed, barricades, lighting, and guardrails as required to protect the general public, workers, and adjoining property. Coordinate with the requirements of Section 01 55 26.13 - TRAFFIC CONTROL.
- F. Fall protection shall be provided whenever the work is at heights greater than six feet, and or where holes and openings exceed six feet in depth. CONTRACTOR shall provide barriers at floor openings and demolished stairways and vertical shafts, and maintain same at all times that a potential fall hazard to workers may exist. The design and use of personal fall arrest and restraint systems, and training of personnel shall comply with ANSI standards. Safety harnesses shall be required for all fall arrest systems. Safe access shall be maintained at all times by the use of scaffold ladders, stair towers, or other acceptable means. Platform planks shall be used in lieu of the commonly used single plank during erection and dismantling.
- G. Comply with governing regulations pertaining to environmental protection. Coordinate with the requirements of Section 01 57 19 - ENVIRONMENTAL PROTECTION.

- H. Conduct demolition operations to prevent migration of dust, dirt, and debris to adjacent structures and improvements. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering into the air. All trucks must be covered when transporting debris from the work site. All vehicles leaving the job site must be cleaned to avoid distribution of dust and dirt to the surrounding areas. Coordinate with the requirements of Section 01 14 19.25 - DUST CONTROL.
- I. Upon completion of structural demolition, all areas within the Limit of Work shall be graded, in accordance with the requirements of Section 31 00 00 - EARTHWORK.

## PART 2 – PRODUCTS

Not Used

## PART 3 - EXECUTION

### 3.01 DEMOLITION:

- A. Demolition shall be by mechanical methods unless otherwise approved. No blasting shall be permitted without prior approval from the ENGINEER.
- B. Remove and properly dispose off-site of all above-ground, at grade and below-ground building structures, including foundations unless otherwise specified.
- C. Properly remove and dispose of all OHM material items, asbestos-containing material, and any lead based coatings removal necessary to perform demolition work, as applicable, prior to any physical building demolition, in accordance with the requirements of other sections of these specifications. Any critical structural supports that are lead coated shall be removed and disposed only after a reviewed temporary support system is provided in its place.

### 3.02 DEMOLITION MATERIAL HANDLING AND REMOVAL:

- A. The demolition debris generated by the demolition activities shall be sorted, and to the extent practical, shall be recycled. The CONTRACTOR shall dispose of as much of the steel, surplus concrete, and rubble as possible at a facility that will recycle such material. General demolition debris that is not recycled shall be disposed of at appropriate designated licensed solid waste disposal facilities, as defined by **M.G.L. Chapter 111, Section 150A**.
- B. All material removed from the site shall be transported from the site by licensed haulers, via designated truck routes, using appropriate vehicles, containment, and documentation. No material shall leave the site without an associated tracking document; the form of such tracking documents shall be acceptable to the ENGINEER. Where the means of tracking does not have a preprinted unique alphanumeric identifier, CONTRACTOR shall assign



and record a tracking number for the document prior to transport of the material from the site.

- C. CONTRACTOR shall maintain a Material Tracking Log that documents and tracks all material removed from the site. For each load of material removed from the site under any Section of these Specifications, whether transported to a recycle, reuse, or disposal facility, the CONTRACTOR shall record at a minimum the following information: a) nature and description of material; b) associated Division 2 Specification Section under which the material was removed; c) business name of licensed hauler; d) vehicle identifier; e) weight or quantity of material in hauler's load; f) type of tracking document and associated document's unique alphanumeric identifier for bill of lading, manifest, or other record being used to track hauler's load; g) date of transport from the site; h) date of arrival at the receiving facility; and i) unique number or identifier of associated receiving facility weight slip or receipt.
1. The Material Tracking Log shall be updated no less than daily, and shall be available to the ENGINEER for review at all times during normal work hours.
  2. A copy of the complete Material Tracking Log shall be submitted to the ENGINEER prior to Final Completion.

END OF SECTION

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## SECTION 02 83 19

### LEAD BASED COATINGS REMOVAL

#### PART 1 - GENERAL:

##### 1.01 DESCRIPTION:

- A. This Section specifies demolition of structures involving lead paint.
- B. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Section in Division One through Sixteen of these Specifications.
- C. Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section. A lead determination at the site indicates that various components are considered to be lead containing.
- D. The work of this section shall be performed as stated herein. In performing the work of this section, the Contractor shall refer to other Sections for additional procedures. The Contractor is responsible for the coordination of the work of this section with related work. No delays in completion of the work may be claimed for lack of coordination.
- E. Contractor shall comply with all applicable local, state, and federal guidelines and regulations regarding all work involving the presence of lead-containing paint.
- F. The work of this section references work of the Contractor performing the renovation/demolition work. Additionally, requirements of the General Contractor regarding coordination and related work are identified in this section and shall be considered the responsibility of the General Contractor.

##### 1.02 DESCRIPTION OF WORK:

- A. The work of this section includes the proper handling of lead coated surfaces in advance of the demolition of Site buildings. The procedures described herein apply to all demolition work where a worker may be occupationally exposed to lead as well as to the disposal of the demolition debris. The Contractor shall assume that any painted surface not tested under this specification shall be assumed to contain lead and it shall be the Contractor's responsibility to protect workers performing under this Contract. This may require additional testing by the Contractor to verify lead content.

B. The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling and disposal of hazardous waste, protection of workers and visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the Owner, Engineer and Engineer's Subconsultant (if any) harmless for failure to comply with any applicable work, hauling, disposal, safety, health or regulation on the part of itself, its workers or its subcontractors.

C. The Contractor is required to ensure the protection of workers performing any related renovation work that will affect surfaces coated with lead containing paint as well as protecting the public and the environment from exposure to lead dust.

D. CODES AND STANDARDS:

1. All work shall conform to the standards set by applicable Federal, State and local laws, regulations, ordinances, and guidelines in such form in which they exist at the time of the work on the contract and as may be required by subsequent regulations.
2. In addition to any detailed requirements of the Specification, the Contractor shall at his own cost and expense comply with all laws, ordinances, rules and regulations of Federal, State, Regional and Local Authorities regarding handling and storing of lead waste material.
3. The following references are cited as applicable standard and regulations as amended:

a. Code of Federal Regulations (CFR) Publications:

|                     |                                                                       |
|---------------------|-----------------------------------------------------------------------|
| 29 CFR 1910         | General Industry                                                      |
| 29 CFR 1926.55      | Gases, Vapors, Fumes, Dusts and Mists                                 |
| 29 CFR 1926.57      | Ventilation                                                           |
| 29 CFR 1926.62      | Lead in Construction                                                  |
| 29 CFR 1926.200     | Signs, Signals and Barricades                                         |
| 29 CFR 1926.354     | Welding, Cutting and Heating in Way of Preservative Coatings          |
| 29 CFR Subpart T    | Demolition                                                            |
| 40 CFR 50           | National Primary and Secondary Ambient Air Quality Standards for Lead |
| 40 CFR 61 Subpart A | General Provisions                                                    |

- |                    |                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------|
| 40 CFR 61.152      | Standard for Waste Manufacturing, Demolition, Renovation, Spraying, and Fabricating Operations. |
| 40 CFR 241         | Guidelines for the Land Disposal of Solid Wastes                                                |
| 40 CFR 257         | Criteria for Classification of Solid Waste                                                      |
| 40 CFR 261 and 262 | Waste Disposal Facilities and Practices                                                         |
- b. Massachusetts Regulations:
- |               |                            |
|---------------|----------------------------|
| 454 CMR 23.00 | Occupational Lead Exposure |
|---------------|----------------------------|
- c. American National Standards Institute (ANSI) Publications:
- |          |                                                                          |
|----------|--------------------------------------------------------------------------|
| 29.2-79  | Fundamentals Governing the Design and Operation of Local Exhaust Systems |
| 288.2-80 | Practices for Respiratory Protection                                     |
- d. National Institute of Occupational Safety and Health (NIOSH) Publications:
- Manual of Analytical Methods, 4<sup>th</sup> Ed.
- e. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory Publications:
- |                 |                                                                   |
|-----------------|-------------------------------------------------------------------|
| 586-77 (R 1982) | Test Performance of High Efficiency Particulate, Air Filter Units |
|-----------------|-------------------------------------------------------------------|

- E. All regulations by the above and other governing agencies in their most current version are applicable throughout this project. Where there is a conflict between this Specification and the cited State, Federal, or local regulations, the more restrictive or stringent requirements shall prevail.

THIS SECTION REFERS TO MANY REQUIREMENTS FOUND IN THESE REFERENCES, BUT IN NO WAY IS IT INTENDED TO CITE OR REITERATE ALL PROVISIONS THEREIN OR ELSEWHERE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO KNOW, UNDERSTAND, AND ABIDE BY ALL SUCH REGULATIONS AND COMMON PRACTICES.

### 1.03 DEFINITIONS:

A. The following definitions apply to the performance of the work of this project.

1. Action Level: An airborne concentration of lead above 30 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) as a time weighted average (TWA) for more than 30 days per year.
2. Area Monitoring: Sampling of lead concentrations within the work area and outside the work area which is representative of the airborne concentrations of lead.
3. Clean Room: An uncontaminated change room directly adjacent to the work area having facilities for storage of employees' personal clothing and uncontaminated work clothes, materials and equipment provided when the airborne exposure to lead is above the PEL.
4. Contractor: The Contractor who is performing work involving lead containing paint under this Section.
5. Decontamination Area: A contained area adjacent to or connected to the abatement work area and consisting of an equipment room, shower area, and clean room which is used for decontamination of workers, materials and equipment.
6. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuuming or exhaust ventilation equipment with a UL 586 filter system. Filters shall be of 99.97 percent efficiency for retaining 0.3 micrometer diameter particles.
7. Lead-Containing Paint: Paint, varnish, or stain, which contains lead in excess of 0.0% lead by weight.
8. Lead Permissible Exposure Limit (PEL): 50  $\mu\text{g}/\text{m}^3$  of air, based upon an 8-hour time weighted average.
9. Sample Location: Area or place where an air or wipe sample is collected.
10. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average for the test of the concentration of lead for worker exposure.
11. Wet Cleaning: The process of removing lead contamination from building surfaces, equipment and other objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as lead contaminated wastes.
12. Work Area: A controlled-access work area, which has no plastic sheeting or other containment barriers, erected to separate the trades.

#### 1.04 SUBMITTALS:

##### A. NOTIFICATIONS:

1. Provide in proper and timely fashion, all necessary notifications to relevant federal, state, and local authorities and obtain and comply with provisions of all permits or applications required by the work specified, as well as make all required submittals required under those auspices. Contractor shall indemnify Owner, Engineer and Consultant from, and pay for all claims resulting from failure to adhere to these provisions. Costs for all permits, applications, and the like are to be assumed by Contractor. Required notifications include but are not limited to the following:
  - a. Massachusetts Department of Environmental Protection, Form AQ06 - Construction/Demolition Notification.

##### B. Provide four (4) copies of the following Submittals at the Pre-Construction Conference:

1. Copies of all notifications, permits, applications, licenses and like documents required by Federal, State, or local regulations and this specification obtained or submitted in proper fashion,
2. Copies of written medical opinions for each employee who may be occupationally exposed to lead as required by 29 CFR 1926.62 (j)(3)(v),
3. Copies of supervisors' and workers' training certificates,
4. Record of successful respirator fit testing performed by a qualified individual within the previous 6 months for each employee to be used on this project with the employee's name and social security number with each record,
5. Employer's Lead Compliance Program as required by 29 CFR 1926.62, including proposed respiratory protection program and medical monitoring for all employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used; worker orientation plan; written description of all proposed procedures, methods, or equipment to be utilized, including those that may differ from the Contract Specifications. In all instances, Contractor must comply with all applicable federal, state and local regulations.
6. Proposed number and type (i.e., hazardous waste or non-hazardous waste, open top, front loading, etc.) of dumpsters for waste, proposed location(s),
7. A list of all equipment to be used on site, by make and model,
8. Chain of Command of responsibility at work site including supervisors and competent person, their names, resumes and certificates of training and phone numbers,

9. List of total number of supervisors and workers intended to be assigned to the project, including name and lead awareness qualifications,
10. Material Safety Data Sheets on potentially hazardous materials to be used on the project,
11. Waste Disposal Plan which describes the waste stream and the disposal means (i.e. landfill, recycle, etc.) and includes the name, address, and ID number of the proposed hazardous waste hauler, waste transfer route, and proposed disposal reclamation or treatment facility,
12. Name and address of the proposed construction debris site,
13. Construction schedule including sequence of critical work.

No work on the project will be allowed to begin until the Pre-Construction Submittals as listed herein are accepted by Engineer. Any delay caused by the Contractor's refusal to submit this documentation in a timely fashion does not constitute a claim for extra compensation or a time extension.

C. Submit the following to the Engineer as a Post-Construction submittal package:

1. Copies of waste manifests and receipts acknowledging disposal of all lead waste material from the project, showing delivery date, quantity, and appropriate signature of landfill's authorized representative,
2. DEP approval for all waste reduction techniques, if utilized,
3. A notarized copy of the daily list of workers and site entry-exit logbook,
4. All personnel monitoring results,
5. All TCLP testing results.

1.05 GENERAL WORK PROCEDURES:

- A. Work shall be carried out in sequential phases. Inspection and approval of each phase by the Engineer shall be sought and gained before proceeding to the next phase and in accordance with the schedule approved. This shall include demolition requirements for work area clearance and work area release before other work. As a Contract requirement, any reasonable delay caused by this requirement will not constitute a basis for claim against the Engineer or Consultant. Contractor must coordinate the work of this section with the work of all other trades.

- B. At no time will Owner permit storage of debris generated from demolition activities to be stored inside buildings at the site, and any storage of materials will be subject to Owner's approval. Assure security of debris at all times.

1.06 REPORT OF FINDINGS:

- A. Testing for lead paint has been performed on a representative number of painted components within the Site buildings using Atomic Absorption Spectrometry (AAS) analysis of paint chip samples. Testing results are summarized in the following table.

***Lead Paint Sample Results***

*Lead Paint Sample Results*

| Sample ID | Sample Description                      | Analytical Results<br>(% lead by weight) |
|-----------|-----------------------------------------|------------------------------------------|
| L1        | Office Bathroom-Light blue wall paint   | <0.0081 % wt                             |
| L2        | Office Exterior-White trim paint        | 11.9 % wt                                |
| L3        | 2-Bay Garage Exterior-Grey/green paint  | 0.147 % wt                               |
| L4        | Shop Office Exterior-Green paint        | <0.0064 % wt                             |
| L5        | Sale Shed Garage Exterior-Grey paint    | <0.0064 % wt                             |
| L6        | 4-Bay Garage Exterior-Grey paint        | 0.0105 % wt                              |
| L7        | 4-Bay Garage Interior-Office white wall | <0.0064 % wt                             |
| L8        | 4-Bay Garage Interior-White paint       | <0.0064 % wt                             |



#### 1.07 SPECIAL CONSIDERATIONS:

- A. The Contractors shall follow the requirements of this section regarding component removal, demolition, worker exposure and protection, work area cleaning, and waste disposal.
- B. Work Affected – In general, the following activities are minimum requirements of this section and affect the demolition performed on the painted components:
  - 1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.
  - 2. No demolition activities may occur which increase the workers' exposure above the Action Level of 30  $\mu\text{g}/\text{m}^3$ . Contractor shall fully comply with the OSHA lead standard at 29 CFR 1926.62.
  - 3. Workers shall be informed of the components to be renovated or demolished that have been identified as containing lead.
  - 4. Worker protection, at a minimum, shall comply with the OSHA Lead Standard 29 CFR 1926.62. Worker Right to Know and Health and Safety Standards of 1926.62 shall also apply to the work of this section.
  - 5. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same vicinity as demolition-involving components identified with lead.
  - 6. Clean-up Activities: The Contractor shall maintain work zones free of accumulated debris and paint chips.

#### 1.08 FEES, PERMITS & LICENSES:

- A. The Contractor shall pay all licensing fees, royalties, and other costs necessary for the use of any copyrighted or patented product, design, invention, or process in the performance of the work specified in this section. The Contractor shall be solely responsible for costs, damages, or losses resulting from any infringement of these patent rights or copyrights. The Contractor shall hold the Owner, Engineer and Engineer's Subconsultant (if any) harmless from any costs, damages, and losses resulting from any infringement of these patent rights or copyrights. If the Contract Documents requests the use of any product, design, invention, or process that requires a licensing, patent or royalty fee for use in the

performance of the job, the Contractor shall be responsible for the fee or royalty fee and shall disclose the existence of such rights.

- B. Contractor shall be responsible for costs for all licensing requirements, where applicable and notification requirements and all other fees related to the Contractor's ability to perform the work in this Section.
- C. Secure all necessary permits for work under this Section, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

#### 1.09 CLEAN-UP:

- A. Maintain the work site in a neat and orderly manner at all times, so as not to interrupt or infringe upon the work of other trades.
- B. Comply with all requirements for release of work areas as described in the project specification.
- C. It is the prerogative of the Engineer to inspect whenever deemed necessary, the Contractor is responsible for meeting, and correcting any deficiencies discovered which do not meet the current applicable regulations and requirements of these specifications.

#### 1.10 COORDINATION:

- A. At no time shall Contractor cause or allow to be caused conditions which may cause risk or hazard to the general public or conditions that might impair safe use of the facility. The use of the facility's electricity, water or like utilities by the Contractor shall be as specified in Division 1.
- B. Coordinate the work of this section with that of all other trades. Phasing and scheduling of this project will be subject to the approval of the Engineer. The work of this Section shall be scheduled and performed so as not to impede the progress of the project as a whole. Work shall not proceed in any area without the express consent of the Engineer. The Contractor shall be available within 24-hours notice for additional work if after acceptance of the work it is found that complete demolition was not achieved from the initial work effort as determined by the Engineer.
- C. The proposed schedule for the work in this Section shall show the time involved from start to finish of demolition operations, including preparation, removal, clean-up, Consultant's inspections and de-mobilization portions of the job.
- D. A final schedule shall then be prepared and coordinated with the Owner, Engineer and Engineer's Subconsultant (if any). The final scheduling shall be submitted in writing before the commencement of work.

- E. Complete activities in the phases of the agreed upon final schedule. The work must be completed in a continuous, uninterrupted operation.
- F. Unless specifically authorized by the Engineer, the work of this project shall be conducted according to the hours established in Division 1.
- G. Inspections: The Engineer may perform visual inspections during the work of this section, as described below. Contractor shall not proceed with work until Contractor has received Engineer's approval at the stages identified below:
  - 1. During: Before the commencement of a proposed alternative method other than specified.
  - 2. Post Inspection: At the completion of work and final clean-up, before clearance or removal of any critical barriers and decontamination unit from the work area.
  - 3. Waste Removal Inspection: Notify Engineer of impending removal of hazardous waste from the site.

#### 1.11 AUTHORITY TO STOP WORK:

- A. The Engineer has the authority to stop the demolition work, at any time the Engineer determines that conditions are not within the specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Engineer. Standby time required to resolve violations shall be at the Contractor's expense, and shall not be cause for extending the completion date.

#### 1.12 EMERGENCY PRECAUTIONS:

- A. The Contractor shall establish emergency and fire exits from the work area.
- B. When an injury occurs, the Contractor shall stop work until the injured person has been removed from the work area.

#### 1.13 DISPOSAL OF WASTE MATERIAL:

##### A. GENERAL:

- 1. Contractor and transporting Contractor will be required to comply with the Resource Conservation and Recovery ACT (RCRA) and with all applicable state and local regulations.
- 2. Contractor shall be responsible for disposing of all waste determined by Toxicity Characteristic Leachate Procedure (TCLP) to be hazardous. If TCLP testing has not been performed, the Demolition Contractor shall be responsible for testing the waste.

3. Contractor and all sub-contractors shall comply with all EPA regulations.

## PART 2 – PRODUCTS

### 2.01 GENERAL REQUIREMENTS:

- A. The Contractor shall deliver all materials and equipment to the site in the original containers bearing the name of the manufacturer, and details for proper storage and use.
- B. All materials or equipment delivered to the site shall be unloaded, temporarily stored, and transferred to the work area in a manner that shall not interfere with other trades working in the area.
- C. Unloading and temporary storage sites, and transfer routes, must be approved in advance by the owner.
- D. Damaged or deteriorated materials may not be used and must be promptly removed from the premises. Material that becomes contaminated shall be packaged and legally disposed in an approved, secure landfill.

### 2.02 MATERIALS:

- A. All materials and equipment proposed to be used on this project shall be subject to the acceptance of the Engineer. The list of required materials shall include, but not necessarily be limited to the following:
  1. Fire retardant polyethylene sheeting, minimum thickness of six (6)-mil.
  2. Plastic bags, minimum thickness of six (6)-mil.
  3. Duct Tape, up to 3-inch width.
  4. Lead Warning Signs, as required by the DLWD Regulations and OSHA Hazard Communication requirements.
  5. Flexible duct for ventilation units (if required).
  6. Spray adhesive, fire retardant.
  7. Personal Protective Equipment, NIOSH approved respirators.
  8. Ventilation units with HEPA filtration and exhaust fans.
  9. HEPA vacuums.

10. Trisodium-Phosphate (TSP) and product data.

11. Cloth tarpaulin.

#### 2.03 TOOLS AND EQUIPMENT:

- A. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, transporting, and unloading waste without exposure to persons or property. All over-the-road transportation equipment must carry the appropriate hazardous waste transport licenses and insurance.
- B. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems.
- C. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for water application.
- D. Other Tools and Equipment: The Contractor shall provide other suitable tools including but not limited to: rounded edge shovels, rakes, brooms, and carts.
- E. The Contractor shall provide ground fault circuit interrupters (GFCI) to protect all electrical cord and connections.
- F. Approved lighting equipment for use in the work area.
- G. Scaffolding: Scaffolding, as required to accomplish specified work, shall meet all applicable Federal, State and local safety regulations and used in accordance with manufacturer's specifications.

### PART 3 – EXECUTION

#### 3.01 SCHEDULING:

- A. The Contractor shall coordinate all scheduling with the Engineer. A schedule of work shall be submitted to the Engineer before contract performance.

#### 3.02 UTILITIES:

- A. Provide all necessary connections for temporary utilities in the workplace during work. Shut down and disconnect all electrical power to the work area so that there is no possibility of reactivation and electrical shock during the work. The temporary electrical power shall be in accordance with all OSHA requirements.

### 3.03 IDENTIFICATION OF HAZARDS:

- A. Prior to any work involving lead-containing items, the Contractor shall identify all work activities in which a worker may be occupationally exposed to lead.
- B. The Contractor shall initially determine if any worker may be exposed to lead above the action level.

### 3.04 BARRIERS AND ISOLATION AREAS:

- A. All lead in demolition work areas shall remain isolated from all other trades on the project and remain inaccessible to the public. Contractor shall monitor the access to the demolition work areas. The below listed items are required to control the generation of lead-containing dust during demolition activities. The Contractor is ultimately responsible for cleaning all generated dust and paint debris from demolition operations and must maintain work areas free from lead dust generated from demolition activities.
  - 1. Signs shall be posted at all approaches to the work area warning that work-involving lead is being conducted in the vicinity. Signs shall be in bold lettering not smaller than two inches tall.
  - 2. Barriers shall not be removed until the work areas are thoroughly cleaned and approved by the Consultant.

### 3.05 APPROVALS AND INSPECTIONS:

- A. All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet this Section along with EPA, OSHA, regulations and recommendations as well as federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies. All work performed by the Contractor is further subject to approval of the Engineer.

### 3.06 PERSONNEL SAMPLING – CONTRACTOR:

- A. Perform personnel air sampling during all demolition work to determine worker exposure limits. The results of such sampling shall be posted, provided to individual workers, and submitted to Engineer as described herein.
- B. Provide sampling to check personal exposure levels. Representative sampling shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken for repeated working conditions if working conditions remain unchanged, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-Weighted-Averages (TWA). Personal sampling shall be as outlined in OSHA Standard 29 CFR 1926.62.

- C. Air sampling results shall be transmitted to the Engineer and individual workers available at the job site in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers (last four digits only), flow rate, sample duration, sample yield, cassette size, and analyst's name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ( $\mu\text{g}/\text{m}^3$ ).
- D. The Contractor's testing lab shall be AIHA accredited for analysis of metals. Contractor shall submit for Engineer's review and acceptance the name and address of the laboratory, certification(s) of AIHA accreditation for metal analysis, listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control program.
- E. Air monitoring frequency will be established in accordance with the requirements set forth in 29 CFR 1926.62.

### 3.07 WORK PROCEDURES:

- A. The Contractor shall initiate, and continue, sufficient engineering and work practice controls, as described in the Contractor's Lead Compliance Program, to reduce and maintain worker exposures to lead at or below the Action Level.
- B. The following work practices are specifically required by these specifications:
  - 1. All persons except those directly involved in the work shall be excluded from the work area. Physical barriers shall be used, where necessary, to limit access to the work area for the duration of the demolition operations. Warning signs may be posted in accordance with applicable regulations.
  - 2. Provide hand-washing facilities and assure that all workers thoroughly wash their hands and face upon exiting the work area. Workers shall pay careful attention to cleanse the hands and face when decontaminating. Provide hygiene facilities, including shower, as required based on initial assessment and continued monitoring.
  - 3. Thoroughly wet the buildings or areas to be demolished and mist the air to reduce the potential for creating airborne lead and dust.
  - 4. All equipment used by the workers inside the work area shall be either left in the work area or thoroughly decontaminated before being removed from the area. Extra work clothing (in addition to the disposable suits supplied by the Contractor) shall be left in the clean area until the completion of work in that area. The clean area shall be cleaned of all visible debris and disposable materials daily.

5. Under no circumstances shall workers or supervisory personnel eat, drink, smoke, chew gum, or chew tobacco in the work area; to do so shall be grounds for the Engineer to stop all demolition operations. Only in the case of life threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.
  6. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.
  7. No demolition activities may occur which increase the workers exposure above the Action Level of  $30 \mu\text{g}/\text{m}^3$ . Contractor shall fully comply with the OSHA lead standard 29 CFR 1926.62.
- C. Workers shall be informed of the components to be renovated that are identified as containing lead.
- D. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same areas as demolition involving components identified as containing lead. Other trades may not enter these areas until clean-up procedures are completed.
- 3.08 STORAGE OF WASTE:
- A. Use of waste containers on site shall be controlled under the following requirements:
1. Location of waste containers on site shall be subject to Owner's approval.
  2. The waste containers lined shall be lined with two layers of six-mil polyethylene sheeting, be solid, enclosed containers, locked and sealed at all times. This requirement applies to waste classified as hazardous based on TCLP testing.
  3. Contractor shall comply with all federal, state, and local regulations and ordinances regarding lead waste storage.

END OF SECTION



## SECTION 03 05 10

### CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE

#### PART 1 - GENERAL

##### 1.01 SUMMARY:

- A. Furnish the following items for installation under related sections:
  - 1. High performance, concrete moisture vapor reduction admixture (MVRA) for all new concrete slabs on grade, elevated slabs, and stair treads and landings under Section 03 30 00 - CAST-IN-PLACE CONCRETE that will receive flooring.

##### 1.02 RELATED REQUIREMENTS:

- A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Cast-in-place concrete materials and placement, and vapor retarder.
- B. Section 09 67 23 – RESINOUS FLOORING: Flooring materials installed over concrete slabs that contain integral waterproofing and for preparation requirements.

##### 1.03 DEFINITIONS:

- A. Cementitious Materials: Portland cement alone or in combination with any of the following; blended hydraulic cement, fly ash and other pozzolans, ground granulated blast- furnace slag, and silica fume; subject to compliance with requirements.

##### 1.04 REFERENCES:

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. ASTM D 5084: Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
  - 2. ASTM E 1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
  - 3. ASTM E 1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
  - 4. ASTM F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
  - 5. ASTM C 494/C 494M-08a Chemical Admixtures for Concrete Type S.

#### 1.05 SUBMITTALS:

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTALS:
  - 1. Product Data: Manufacturer's printed data sheets.
    - a. Include standard slab repair details.
    - b. Include vapor barrier data showing compliance with this section.
  - 2. Product test reports performed by a qualified independent testing agency evidencing compliance of products with specified requirements of water-vapor transmission based on comprehensive testing of current products.
  - 3. Manufacturer's certificate certifying admixture provided meets or exceeds specified requirements.
  - 4. Sample warranty, including adhesion guarantee and moisture letter.

#### 1.06 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: A firm with not less than ten (10) years' experience in the manufacture of the specified concrete moisture vapor reduction admixture, capable of providing test reports indicating compliance with specified performance requirements, and able to provide on-site technical representation should the need arise. Selected product must have certification of compliance with ASTM C494 /C494M testing protocols from an independent AASHTO approved laboratory.
- B. Pre-installation Conference:
  - 1. Verify MVRA project specific quality control procedures, review concrete mix designs and examine procedures for ensuring quality of concrete materials. Each entity directly concerned with MVRA dosed concrete must attend in person, conference call, or provide electronic review of documents, mix designs and procedures. Those required to participate or to review include but are not limited to:
    - a. Contractor.
    - b. Independent testing agency responsible for concrete design mixtures, sampling and testing.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
    - e. Moisture Vapor Reduction Admixture manufacturer.
- C. Moisture Vapor Reduction Admixture Collection Agent / Representative Qualifications
  - 1. Personnel conducting field sampling on behalf of the MVRA manufacturer shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Quality Control Protocol shall consist of the concrete water vapor transmission

inhibiting admixture representative procuring two random cylinders from every placement of concrete containing the concrete water vapor transmission inhibiting admixture. These cylinders shall be sent to an independent laboratory for hydraulic conductivity (coefficient of permeability) testing per ASTM D 5084. The results of this “project specific” quality control protocol shall form the basis for the issuance of the project specific warranty.

1. Should the Quality Control Protocol deliver results in excess of 6.0 E-08 cm/sec, the concrete water vapor transmission inhibiting admixture manufacturer shall provide, at their expense, an epoxy topical moisture mitigation system for all areas not meeting the stated limit.
  - a. The moisture mitigation system shall include all labor and material for slab profiling, epoxy material, and application.
  - b. The moisture mitigation system shall include a warranty meeting or exceeding the terms of the manufacturer’s warranty specified in this Section.

E. Toxicity/Hazardous Materials: Provide products that contain no urea-formaldehyde.

F. Repairs to slabs must be in accordance with concrete industry standards and meeting waterproofing admixture manufacturer’s published details.

#### 1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Comply with manufacturers written instructions for handling prior to adding to concrete batch.
- B. Store both components protected from exposure to harmful weather conditions and in a temperature controlled area above 36 degrees F. Do not allow product to freeze.

#### 1.08 WARRANTY:

A. Special Warranty: Provide manufacturer's standard warranty documents executed by an authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the owner may have under provisions of the Contract Documents.

1. Warranty Period: Life of the concrete.
  - a. Warranty requirements: Said product must be installed according to and in compliance with the manufacturer’s published data sheet to include but not limited to dosing instructions, onsite representation requirements, and the use of an ASTM E 1745 vapor retarder, installed following ASTM E 1643 and ASTM F 710 guidelines; elevated concrete slabs do not require a vapor retarder.
    - 1) Repair and/or removal of failed flooring.
    - 2) Placement of a topical moisture remediation system.
    - 3) Replacement of flooring materials like original installed to include material and labor.
    - 4) MVRA manufacturer shall provide an adhesion warranty to match the term of the adhesive manufacturer’s warranty in

accordance with the MVRA manufacturer's requirements for conveyance of such.

2. Warranty Basis: Follow Quality Control Protocol specified in this Section, achieving a maximum coefficient of permeability of  $6.0 \text{ E-}08 \text{ cm/sec}$  on all project test samples.

## PART 2 - PRODUCTS

### 2.01 CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE:

- A. Concrete Moisture Vapor Reduction Admixture (MVRA): Concrete moisture vapor reduction admixture for all interior slabs on grade shall be a non-toxic, liquid admixture that is specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system. The chemical reaction forms a permanent barrier (capillary break) that is integral to the concrete, insoluble and irremovable.
  1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on ISE Logik Industries, Gulfport, MS, product "MVRA 900".
  2. Provide the above-named product or approved equal upon receipt of approval from the Engineer, provide a product that meets or exceeds the following project specific performance requirements at the expense of the concrete moisture vapor reduction admixture (MVRA) manufacturer:
- B. Project specific quality control process to include, but not be limited to:
  1. Independent procurement of one cylinder per day of placement of concrete containing MVRA.
  2. Independent testing of all cylinders for hydraulic conductivity per ASTM D 5084.
  3. Assessing each cylinder for maximum flow of  $6.0 \text{ E-}08 \text{ cm/sec}$ .
  4. Should any cylinder exceed the maximum flow, procure a core from that day's placement.
  5. Independently test core for hydraulic conductivity per ASTM D 5084.
  6. Should any core exceed the maximum flow, provide a topical moisture mitigation system for all areas not meeting the stated limit; moisture mitigation system to include all labor, material and warranty that meets or exceeds the terms of the concrete moisture vapor reduction admixture manufacturer's warranty.

### 2.02 MATERIALS:

- A. Concrete Water Vapor Transmission Inhibiting Admixture: Non-toxic, liquid admixture for concrete that reacts with water and portlandite filling the capillary system with calcium silicate hydrate (CSH) to eliminate the route for moisture migration. Once the admixture is added to the mix design, the admixture shall react

with the water to allow the concrete to be flexible, even at low slump.

1. Product Description: Concrete water vapor transmission inhibiting admixture shall be a complex formula that is free of all volatile organic compounds (VOC). It shall be specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through concrete by closing down the integral capillary system. The chemical reaction shall form a permanent barrier (capillary break) which is integral to the concrete and irremovable.
  - a. Water Vapor Transmission: 0.20 US perms per ASTM D 5084
  - b. Appearance: Colorless.
  - c. Odor: None.
  - d. Toxicity: None.
  - e. Flammability: None.
  - f. Ph: 11.3.
  - g. Shelf Life: Indefinite.
  - h. Weight: 11.2 lbs per gallon.
  - i. Freeze Temp: 32°F.
  - j. Storage Temp: Above 36°F.
  - k. Solvent: Water.
  - l. Acid Resistance: Excellent.
  - m. Hazardous Vapors: None.
  - n. Capillary Break: Calcium Silicate Hydrate Gel.
  - o. Installation: All concrete.
  - p. VOC Levels: Zero.

- B. Provide manufacturer's standard anti-microbial biocide to inhibit mold and bacteria growth.

## 2.03 ACCESSORIES:

- A. Sheet Vapor Retarder: As specified in Section 07 26 00 – VAPOR RETARDERS. Comply with the following:
  1. 0.01 US perms (grains/ft<sup>2</sup>\*hr\*inHg) or less after the required product conditioning specified in ASTM E 1745-09 Include manufacturer's recommended adhesive or pressure-sensitive tape.

## PART 3 - EXECUTION

### 3.01 APPLICATION:

- A. Install vapor barrier following ASTM E 1643-98(2005) guidelines and in accordance with Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- B. Moisture Vapor Reduction Admixture: Add admixture in accordance with manufacturer's recommendations to all ready-mix concrete, at the

batch plant or at the job site.

1. A representative or agent of the manufacturer must be present at the jobsite during the placement of all treated concrete. Do not proceed without the representative being present for the certification of the mix and placement process. Provide minimum 10 days notice of the placement of the treated concrete.
  2. The Quality Control Protocol for admixture shall consist of the representative procuring two random cylinders from every placement of concrete containing admixture. These cylinders will be sent to an independent laboratory for hydraulic conductivity (coefficient of permeability) per ASTM D5084. The results of this "project specific" quality control protocol forms the basis for the issuance of the project specific warranty.
- C. Dispense admixture at a rate of 14 ounces per 100 pounds of cementitious materials at the tail end of the load, dose to be within plus or minus 3 percent. Additional dosage may be required based on the mix design.
1. Add admixture to ready mix concrete truck, in the require dosage, and mix for 7 (seven) minutes before discharge. Admixture is to be used in lieu of designed mix water, not in addition to mix water.
  2. Do not alter 0.45 water/cementitious materials ratio without prior approval.
  3. The addition of non-chlorinated admixtures is permitted.
  4. The addition of Shrink Reducing Admixtures is not permitted.
- D. Other admixtures may be used in the same concrete batch provided that such admixtures are added separately.
1. The water-to-cementitious material ratio (w/cm) is critical and it is imperative to comply with the mix design. Admixture shall be used in lieu of that portion of the mix water, not in addition to the mix water. Use of plasticizers or water reducers is recommended to achieve slumps greater than 4 inches.

### 3.02 CURING:

- A. Comply with curing requirements in Section 03 30 00 - CAST-IN-PLACE CONCRETE.

### 3.03 FIELD QUALITY CONTROL:

- A. Testing of Slabs Containing MVRA:

1. The moisture vapor reduction admixture (MVRA) manufacturer will perform all moisture testing in accordance with this specification and will issue project specific warranties and adhesion guarantees prior to installation of any slab finishes; no further field slab moisture nor pH testing shall be required.
  - a. Failure to provide a product that meets or exceeds these requirements will result in all subsequent testing and slab remediation costs being borne by the Contractor.
2. A representative or agent of the moisture vapor reduction admixture (MVRA)

manufacturer must be present at the jobsite during placement of all MVRA treated concrete.

- a. Do not proceed without this representative being present.
    - b. A minimum of one business day notification is required.
  3. Field testing technician shall, at the expense of the MVRA Manufacturer, procure at least one 4 inch cylinder from every day of placement of MVRA dosed concrete for the purpose of subsequent hydraulic conductivity/coefficient of permeability testing.
  4. All cylinders shall be independently lab tested in accordance with ASTM D 5084 at the expense of the MVRA manufacturer.
  5. Test results must conform to specified limits.
    - a. Should any cylinder from any day of placement deliver results in excess of  $6.0 \text{ E- } 08 \text{ cm/sec}$ , the concrete moisture vapor reduction admixture manufacturer shall procure, at their expense, a core (or cores) from that day of placement. This core (cores) shall be sent to an independent laboratory for hydraulic conductivity (coefficient or permeability) per ASTM D 5084.
    - b. Should any core deliver results in excess of  $6.0 \text{ E-}08 \text{ cm/sec}$  per ASTM D 5084, the concrete moisture vapor reduction admixture manufacturer shall provide, at their expense, a topical moisture mitigation system for all areas not meeting the stated limit.
  6. Proceeding with placement of concrete dosed with the MVRA without the required representation will result in the contractor bearing the cost to core and ship appropriate material for testing per ASTM D 5084.
- B. Concrete Water Vapor Transmission Inhibiting Tests: If the results of the testing of the original cylinders is inconclusive, additional testing of slabs containing concrete water vapor transmission inhibiting admixture shall be carried out by the concrete water vapor transmission inhibiting admixture manufacturer's technical representative to include: Two random, 4-inch drilled sample cores and/or cylinders on all project slabs.
- C. The sample cores and/or cylinders shall be sent to an independent laboratory and tested for permeability in accordance with ASTM D 5084, and shall achieve a minimum  $6.0 \text{ E-}08 \text{ cm/sec}$ . The results shall be provided to the Contractor and Engineer prior to the installation of floor coverings and as part of the warranty closeout documents.
1. The manufacturer's warranty must be in place prior to installation of flooring materials.
  2. All adhesives used for flooring installation must be compatible with the MVRA and manufactured for non-porous surfaces. Comply with Division 09 Sections for installation.
- D. Additional testing may be required in accordance with the water vapor transmission inhibiting admixture manufacturer's requirements. No other testing shall be required for installation of floor coverings.

### 3.04 REPAIRS:

- A. Make repairs to slab in accordance with Section 03 30 00 - CAST-IN-PLACE CONCRETE and as shown in manufacturer's published details and remediation program.

END OF SECTION

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## SECTION 03 05 13

### CONCRETE SEALERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Furnish and install concrete sealers/coatings on exposed-to-view concrete floors where shown and as scheduled on the Drawings.

##### 1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE:
  - 1. Placing and finishing concrete slabs.
  - 2. Dustproofing concrete slabs exposed to view and substrate for carpet.

##### 1.03 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. AASHTO M233 – Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
  - 2. ASTM C156 – Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
  - 3. ASTM C309 – Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 4. ASTM C1315 - Standard Specifications for Liquid Membrane-Forming Compounds, having Special Properties for Curing and Sealing Concrete.

##### 1.04 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
    - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all coatings.
  - 2. Samples of each level of slip resistance, aggregate, and pattern available in the specified products from the proposed manufacturer.

## 1.05 QUALITY ASSURANCE

- A. Use an applicator approved by the manufacturer, experienced in the approved materials, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

## 1.06 ENVIRONMENTAL CONDITIONS

- A. Work shall be done only under optimum conditions as recommended by manufacturer. Surfaces over which sealer is to be applied shall be completely dry (minimum 30 days since concrete placement) and thoroughly clean. Maximum moisture content is 8 percent. Substrate and ambient temperature shall be between 60 and 90 degrees Fahrenheit (15 to 32 degrees Celsius).

## 1.07 PRODUCT HANDLING

- A. Deliver materials to the job site and store in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.

# PART 2 - PRODUCTS

## 2.01 MATERIALS

- A. Transparent non-yellowing water-based acrylic sealer having a minimum of 25 percent solids, with a maximum VOC limit of 100 g/L. Subject to compliance with ASTM C309, Type 1, Class A, ASTM C1315 Type 1, Class A, and requirements specified herein.
  - 1. Products which may be incorporated in the work include the following, or approved equal:
    - a. Laticrete International Inc., Bethany CT, (L&M Construction Chemicals Brand), Omaha NE, product "Dress & Seal WB25".
    - b. Dayton-Superior, Miamisburg OH, (Symons Brand), Des Plaines, IL, product "Cure & Seal 1315\_J22WB".
    - c. Nox-Crete Inc., Omaha NE, product "Cure & Seal 250E".

# PART 3 - EXECUTION

## 3.01 SURFACE PREPARATION

- A. Upon acceptance of completed substrate surfaces, thoroughly remove all dust and debris by sweeping or vacuum cleaning.
- B. Remove laitance, curing sealers, existing adhesives and other foreign matter from concrete surfaces with necessary techniques such as shot blasting, Muriatic acid etching, surface freezing and power scarification.

- C. Surface preparation required if a curing compound has been applied to substrate surfaces.
1. Thoroughly etch concrete surfaces using well mixed solution consisting of two parts by volume water diluted with one part by volume 30 percent commercial grade hydrochloric acid at a rate of one quart per ten square feet. Apply evenly to thoroughly saturated areas and scrub into surfaces using stiff-bristled broom. Allow solution to activate undisturbed for not less than five minutes or for duration of boiling effect.
  2. Thoroughly remove etching solution by washing down surfaces with clean water; flooded at least three separate times at a rate of two gallons per ten square feet; thoroughly remove all contaminants that may be engrained or latent in surfaces.
  3. Perform a test application of a square foot in three locations, such as beneath casework. Allow to set for 72 hours, and test adhesion as recommended by the manufacturer.

### 3.02 APPLICATION

- A. Apply sealer with manufacturer's recommended sprayer, at recommended rate of 400 square feet per gallon. Apply second coat when sealer is dry to touch. Allow sealer to cure undisturbed for a minimum period of 6 hours. Maintain temperature at 60 degrees Fahrenheit minimum until floor surfacing has completely dry.

END OF SECTION

SECTION 03 30 00  
CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.01 GENERAL PROVISIONS:

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

- A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:
  - 1. Footings
  - 2. Foundation walls
  - 3. Knee walls
  - 4. Slab-on-grade
  - 5. Suspended slabs
  - 6. Interior equipment (housekeeping) pads
  - 7. Exterior slabs, including fuel island, and sidewalks
  - 8. Mud mats
  - 9. Concrete toppings
  - 10. Anchor Rods
  - 11. Grout
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Section 01 45 23, STRUCTURAL TESTS AND INSPECTIONS
  - 2. Section 03 05 10, CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE
  - 3. Section 03 05 13, CONCRETE SEALERS
  - 4. Section 04 20 00, MASONRY
  - 5. Division 5 - METALS
  - 6. Section 06 10 00, ROUGH CARPENTRY

7. Section 07 00 01, WATERPROOFING, DAMPPROOFING AND CAULKING
8. Section 07 26 00, VAPOR RETARDERS
9. Section 13 42 00, PREFABRICATED ENGINEERED BUILDINGS
10. Section 31 00 00, EARTHWORK; Excavation and establishment of subgrade elevations.

1.03 SUBMITTALS:

- A. Refer to Section 01 33 23, SUBMITTALS for submittal provisions and procedures.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, anchor rods, and others if requested by the Engineer or SER.
- C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports for concrete.
  1. Shop drawings for building foundation reinforcing cannot reviewed and approved until pre-engineered anchor bolt drawings and reaction forces are submitted, reviewed, and approved.
- D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.
- E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.
  1. Submit alternate mix designs when the characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
  2. Indicate the amounts of mixing water to be withheld for later addition at the Project site.
- F. Proposed method of curing and associated products.
- G. Proposed precautions for hot weather and cold weather concreting.
- H. Samples: For waterstops.

1. Submit samples of materials as requested by the Engineer or SER, including names, sources, and descriptions.
- I. Laboratory test reports for concrete materials and mix design test.
- J. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:
  1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- K. Material certificates for each of the following, signed by the manufacturers:
  1. Cementitious material.
  2. Admixtures
  3. Form materials and form-release agents.
  4. Steel reinforcement and accessories.
  5. Non-metallic shrinkage resistant grout.
  6. Waterstops.
  7. Anchor Rods.
  8. Curing compounds.
  9. Floor and slab treatments.
  10. Bonding agents.
  11. Adhesives.
  12. Vapor retarders.
  13. Semi-rigid joint filler.
  14. Joint-filler strips.
  15. Repair materials.
- L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- M. Qualification Data: For Installer and Manufacturer.
- N. Minutes of pre-installation conference.
- O. Submit Environmental Product Declarations for each of the following:
  1. Cementitious material.
  2. Admixtures

#### 1.04 QUALITY ASSURANCE:

- A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mix concrete products that complies with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the Commonwealth of Massachusetts as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.
- D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications:
  - 1. Comply with the following unless modified by requirements in the Contract Documents:
    - a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
    - b. ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
    - c. ACI 214, "Evaluation of Strength Test Results of Concrete."
    - d. ACI 301, "Specification for Structural Concrete."
    - e. ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
    - f. ACI 305, "Hot Weather Concreting."

- g. ACI 306, "Cold Weather Concreting."
  - h. ACI 308, "Guide to Curing Concrete."
  - i. ACI 309, "Guide for Consolidation of Concrete."
  - j. ACI 311.1, "ACI Manual of Concrete Inspection."
  - k. ACI 315, "Details and Detailing of Concrete Reinforcement."
  - l. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
  - m. ACI 347, "Guide for Formwork for Concrete."
  - n. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures"
2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.
- F. American Society for Testing and Materials (ASTM):
1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
  2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
  3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."
- G. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M194 "Chemical Admixtures."
- H. Pre-installation Conference: Conduct a conference at the Project site
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
    - e. Structural Engineer.
    - f. Independent testing agency responsible for field testing.
    - g. Owner's Authorized Representative.
    - h. Engineer.
  2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather



concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS:

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Formwork for elements exposed to view, including, but not limited to knee walls, above grade piers, and exposed faces of retaining walls, shall conform to Surface Finish 3.0 per ACI 301.
- B. 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,  $\frac{3}{4}$ -inch by  $\frac{3}{4}$ -inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that 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.

- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.
- H. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.02 STEEL REINFORCEMENT:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
  - 1. Provide reinforcing bars conforming to ASTM A706, Grade 60, deformed, if welding is required.
- B. Plain Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.03 NON-METALLIC SHRINKAGE RESISTANT GROUT:

- A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

## 2.04 REINFORCEMENT ACCESSORIES:

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater of compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
  - 2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

## 2.05 ANCHOR RODS

- A. Anchor Rods: ASTM F 1554, Grade 55 (Weldable), Hot Dipped Galvanized per ASTM A 153. Headed type unless otherwise noted. Provide suitable nuts in accordance with ASTM F1554 and ASTM A563 and washers in accordance with ASTM F436. Nuts and washers shall be hot-dipped galvanized.
- B. Anchor rod required diameters are as specified by the Prefabricated Engineered Building Manufacturer and approved by the Engineer. Embedment depths are as specified by the Engineer.

## 2.06 CONCRETE MATERIALS:

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:
  - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
- B. Fly Ash: ASTM C 618, Class C or F.
- C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.
- D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
  - 1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
  - 2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
  - 3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.
  - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.
- E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse Aggregate Size:  $\frac{3}{4}$ -inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- F. Water: ASTM C 94 and potable.

## 2.07 ADMIXTURES:

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble

chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
  2. Retarding Admixture: ASTM C 494, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor;; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.
1. Products:
  2. Euclid Chemical Company; Eucon CIA.
  3. Grace Construction Products, W.R. Grace & Co.; DCI.
  4. BASF Admixtures, Inc.; Rheocrete CNI.
  5. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Products:
    - a. Grace Construction Products, W.R. Grace & Co.; DCI-S.
    - b. Sika Corporation: Sika FerroGard 903
    - c. Euclid Chemical: Eucon BCN
- E. Concrete Moisture Vapor Reduction Admixture: Refer to Specification Section 03 05 10.
- F. Integral Crystalline Waterproofing Admixture. Incorporate into concrete mix design per the manufacturer's recommendations.
1. Products:
    - a. Penetron Admix, Penetron International Ltd.
    - b. Xypex Admix C-500, Xypex
    - c. Aquafin-IC Admix, Aquafin Inc.

## 2.08 WATERSTOPS:

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete,  $\frac{3}{4}$ -inch by 1-inch.
  - 1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
  - 2. Concrete Sealants, Inc.; Conseal CS-231.
  - 3. Greenstreak; Swellstop.
  - 4. Henry Company, Sealants Division; Hydro-Flex.
  - 5. Progress Unlimited, Inc.; Superstop.
  - 6. TCMiraDRI; Mirastop.
- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete,  $\frac{3}{8}$ -inch by  $\frac{3}{4}$ -inch.
  - 1. Deneef Construction Chemicals; Swellseal.
  - 2. Greenstreak; Hydrotite.
  - 3. Mitsubishi International Corporation; Adeka Ultra Seal.
  - 4. Progress Unlimited, Inc.; Superstop.
- C. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.
  - 1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

## 2.09 FLOOR AND SLAB TREATMENTS:

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
  - 1. Products:
    - a. Burke by Edoco; Titan Hard.
    - b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
    - c. Curecrete Distribution Inc.; Ashford Formula.
    - d. Dayton Superior Corporation; Day-Chem Sure Hard.
    - e. Euclid Chemical Company; Euco Diamond Hard.
    - f. Kaufman Products, Inc.; SureHard.
    - g. L&M Construction Chemicals, Inc.; Seal Hard.

- h. Meadows, W.R., Inc.; Liqui-Hard.
  - i. Symons Corporation, a Dayton Superior Company; Buff Hard.
- B. Exterior slab treatment including at Fuel Island: Clear solvent free silane treatment that is UV stable and vapor permeable to reduce water and chloride ion intrusion.
  - 1. Products:
    - a. Sikagard 740 W by Sika Corporation
    - b. MasterProtect H 1000 (formerly Hydrozo 100) by BASF
    - c. Intraguard by W.R. Meadows
    - d. Or approved equal

#### 2.010 CURING MATERIALS:

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor coverings.
  - 1. Products:
    - a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
    - b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
    - c. Euclid Chemical Company; Diamond Clear VOX.
    - d. Lambert Corporation; Glazecote Sealer-20.
    - e. L&M Construction Chemicals, Inc.; Dress & Seal WB.
    - f. Meadows, W.R., Inc.; Vocomp-20.
    - g. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
    - h. Sonneborn, Div. Of ChemRex; Kure-N-Seal.
    - i. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:

- a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
- b. Euclid Chemical Company; Super Diamond Clear VOX.
- c. Lambert Corporation; UV Safe Seal.
- d. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- e. Meadows, W.R., Inc.; Vocomp-30.
- f. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.011 RELATED MATERIALS:

- A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.012 REPAIR MATERIALS:

- A. Repair Underlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8-inch to 1/4-inch or coarse sand as recommended by the underlayment manufacturer.
  4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C 109.
- B. Repair Overlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8-inch to 1/4-inch or coarse sand as recommended by the topping manufacturer.
  4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C 109.

#### 2.013 CONCRETE MIXTURES, GENERAL:

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.



2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50 or as specified.
4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.
6. Use moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.
7. Use integral crystalline waterproofing admixture in concrete mixtures where indicated.

#### 2.014 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

- A. Footings, Foundation Walls, Kneewalls and Piers: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 4500 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45
  3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
  4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
  5. Corrosion Inhibiting Admixture: Apply to walls and piers at a rate of 2 gallons per cubic yard of concrete.
- B. Interior Slabs-on-Grade and Equipment Pads: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 4500 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45
  3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
  4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

5. Corrosion Inhibiting Admixture: Apply to slabs exposed to vehicles traffic/parking or exposed to chemicals at a rate of 2 gallons per cubic yard of concrete.
  6. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.
- C. Exterior Slabs, Sidewalks, Flagpole Foundations: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.40.
  3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
  4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size
  5. Corrosion Inhibiting Admixture: Apply at a rate of 2 gallons per cubic yard of concrete.
- D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.50
  3. Slump Limit: 4-inches, plus or minus 1-inch, prior to adding high-range water-reducing admixture or plasticizing admixture, maximum slump with admixture is 6 inches
  4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
  5. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.
- E. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45
  3. Slump Limit: 4 inches, plus or minus 1 inch.
  4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
  5. Provide moisture vapor reduction admixture on all slabs to receive floor finishes. Refer to Specification Section 03 05 10.

## 2.015 FABRICATING REINFORCEMENT:

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

#### 2.016 CONCRETE MIXING:

- A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.
- B. When air temperature is between 85- and 90-degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

### PART 3 - EXECUTION

#### 3.01 GENERAL:

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

#### 3.02 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 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. For elements exposed to view, conform to Surface Tolerance A.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8-inch for smooth-formed finished surfaces.
- 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 concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

- G. Provide temporary openings for cleanouts and inspections ports where interior area 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.

### 3.03 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 rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
    - a. Anchor rods shall be installed as specified by the Prefabricated Engineered Building Manufacturer and as approved by the Engineer.
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

### 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 degrees F for 24 hours after placing concrete, if concrete

is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

- B. 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.
- C. 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 forms for exposed concrete surfaces unless approved by the Engineer.

### 3.05 STEEL REINFORCEMENT:

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire ties.

### 3.06 JOINTS:

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches 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 the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
  5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. 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 joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. 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. Terminate full-width joint filler strips not less than 1/2-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.
  2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.07 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 Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and maintaining specified water-cement ratios.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
  - 2. The concrete supplier shall have procedures in place to verify quantity of water added. Quantity shall be noted on delivery ticket.
  - 3. The independent testing agency shall perform tests after water is added
- D. Deposit concrete continuously in one layer or in horizontal 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 indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, providing water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing of concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.08 FINISHING FORMED SURFACES:

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to view.
- B. Smooth-Formed Finish: Provide Surface Finish 3.0 per ACI 301 and Surface Tolerance Class A per ACI 117. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to view including but not limited to knee walls, above grade piers, and exposed faces of retaining walls.
  2. Mock-up of concrete surface appearance is not required.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.



### 3.09 FINISHING FLOORS AND SLABS:

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
  - 3. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
- D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- E. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to all surfaces with truck traffic according to manufacturer's written instructions and as follows:
  - 1. Uniformly apply dry-shake floor hardener at a rate of 100 lb. /100 sq. ft. unless greater amount is recommended by manufacturer.
  - 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.

3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

### 3.010 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 the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: 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 from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.011 CONCRETE PROTECTING AND CURING:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
- 2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.
  - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.
- D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

### 3.012 LIQUID FLOOR TREATMENTS:

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment to concrete floors exposed to view according to manufacturer's written instructions.
  - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Comply with Manufacturer's written instructions for application.

- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

### 3.013 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 one month. 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.

### 3.014 CONCRETE SURFACE REPAIRS:

- A. Defective Concrete: repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact 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 the Engineer.
- 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, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14-days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least  $\frac{3}{4}$ -inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

### 3.015 FIELD QUALITY CONTROL:

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:

1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards 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 mixture. 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 mixture.
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.
  5. Density of Freshly Mixed Concrete: ASTM C 138; for calculating unit weight. Perform test when placing lightweight concrete mixes.
  6. Compression Test Specimens: ASTM C 31.
  7. Cast and laboratory cure five (minimum) standard cylinder specimens for each composite sample.
  8. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
  9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds specified compressive strength and no compressive strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work,

design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28 day tests.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
  2. 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 required by the Engineer. 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 required by the Engineer.
  3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

### 3.016 GROUTING:

- A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

### 3.017 TEST FOR WATERTIGHTNESS:

- A. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer. See Section 03150, WATERSTOPS.
- B. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.
- C. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Engineer. Evaporative losses shall be

calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.

- D. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.
- E. The Contractor shall pay all costs (including water) incurred in the testing for watertightness.
- F. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

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## SECTION 03 30 01

### CAST-IN-PLACE CONCRETE – SALT SHED

#### PART 1 – GENERAL

##### 1.01 GENERAL

- A. Related Documents: All Work under this section shall be performed in accordance with the Drawings and the provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division I—General Requirements of these Specifications.
- B. Scope of Work: Work under this section shall consist of concrete footings as shown on Drawings.

##### 1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. ACI-301, Specifications for Structural Concrete for Buildings.
  - 2. ACI-318, Building Code Requirements for Reinforced Concrete.
  - 3. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
- B. Earth cuts may be used to form concealed vertical surfaces of footings. Earth forms shall be sharp and true to line and dimension.

##### 1.03 SUBMITTALS

- A. Refer to Division I, Section 01 33 00, Submittals.
- B. Material Certificate: submit certificate from concrete supplier, showing compliance with design requirements for strength.
- C. Product Data: submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, and others as requested by Engineer or Owner's designated representative.

##### 1.04 ENVIRONMENTAL REQUIREMENTS

- A. Provide cold weather and/or hot weather protection as recommended in ACI-305 and ACI-306.
- B. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow. Protect concrete from rain water, maintain cement:water ratio, and protect concrete surface.
- C. All concrete shall be adequately protected after pouring to prevent damage from freezing,

by the use of suitable covers and adequate heating equipment. Frozen and damaged concrete must be removed and replaced at the Contractor's expense. Do not place concrete on frozen earth.

## PART 2 - PRODUCTS

### 2.01 REINFORCING MATERIALS

- A. Reinforcing bars shall conform to Specifications for Deformed Billet—Steel Bars for Concrete Reinforcement, ASTM A-615 Grade No. 60, having a minimum yield strength of 60,000 psi.
- B. Tie wire shall be black annealed wire, 16 gauge minimum.
- C. Bar supports shall conform to the Bar Support Specification contained in the Manual of Standard Practice as published by CRSI and WCRSI. Bar and accessories within 1/2 of the surface of concrete exposed to weather shall be non-corrosive.

### 2.02 CONCRETE MATERIAL

- A. Cement shall be grey Portland Cement, Type I or II, conforming to ASTM C-150. Use same brand for all exposed work.
- B. Concrete aggregates shall conform to ASTM C-33. Fine and coarse aggregates shall be regarded as separate ingredients, and each shall conform to the appropriate grading requirements of ASTM C-33.
- C. Water shall be potable, clean, and free from impurities affecting the strength of the concrete, in accordance with ACI and ASTM requirements.

### 2.03 PROPORTIONING AND DESIGN OF MIXES

- A. All concrete shall be of normal weight, consisting of a proportioned mixture of Portland Cement, coarse aggregate, fine aggregate, and water. Concrete proportions shall be selected on the basis of trial mixes conforming to ACI 211.1.
- B. All concrete, unless otherwise noted, shall have a minimum compressive strength of 3,000 psi at 28 days.
  - 1. For fill, 2,000 psi concrete may be used.
- C. All concrete, unless otherwise noted, shall be proportioned to have a slump of 3 minimum to 4 maximum. Tolerance in slump shall not exceed ACI recommendation.
  - 1. Slump for concrete fill may be 6 maximum.
- D. Admixtures to retard or accelerate setting, to reduce water ratio, or to prevent freezing shall not be used without prior approval from the Engineer or the Owner's designated representative. No admixtures containing calcium chloride may be used.
- E. Maximum aggregate size shall conform to the following, and shall not exceed tolerances

on oversize as per ASTM C-33.

- |    |                                        |     |
|----|----------------------------------------|-----|
| 1. | Footings, grade beams, and foundations | 3/4 |
| 2. | Concrete fill                          | 1/2 |

## 2.04 CONCRETE PRODUCTION

- A. Ready-mixed concrete shall conform to ASTM C-94 and the National Ready Mix Concrete Association. Use of non-agitating trucks is not permitted.
- B. Use of retempered concrete is not permitted.
- C. The addition of water at the job site is permitted providing that only sufficient water is used to provide a workable mix, and that neither the design water:cement ratio nor the maximum slump is exceeded. The addition of cement at the job site to maintain the water:cement ratio is not permitted.

## PART 3 – EXECUTION

### 3.01 PLACING REINFORCEMENT

- A. Comply with CRSI's recommended practice for Placing Reinforcing Bars for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by framework, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Coverage: all reinforcing bars below ground shall have minimum 3 concrete cover.
- E. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so that ends are directed into concrete, and not toward exposed concrete surfaces.
- F. Heating of reinforcement for bending will not be permitted.

### 3.02 PLACEMENT OF CONCRETE

- A. Consolidate all concrete in accordance with provisions of ACI-309.
- B. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand-spading, rodding, or tamping.
- C. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation of aggregate.

END OF SECTION

SECTION 04 00 01  
MASONRY FILED SUB-BID REQUIREMENTS  
(FILED SUB-BID REQUIRED)

**PART 1 - GENERAL**

**1.01 GENERAL PROVISIONS**

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 0 – Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the filed sub-bid “Masonry” include all of the following listed Specification Sections: in their entirety:

***1. Section 04 00 01 - MASONRY FILED SUB-BID REQUIREMENTS.***

***2. Section 04 20 00 – UNIT MASONRY***

***3. Section 04 72 00 – CAST STONE MASONRY***

- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

***Volume I Drawings Below:***

***General: G000, G001, G101, G102, G201, G202, G301***

***Civil: C001, C200, C201, C202, C300, C301, C302, C401***

***Structural: S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S121, S201, S202, S301, S302, S303, S304, S305, S306, S311, S312, S901***

***Architectural: A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A112, A113A, A113B, A113C, A114, A115A, A115B, A115C, A201, A211, A212, A213, A221, A231, A232, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A511, A512, A601, A602, A611, A612, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841, A851, A901, A932***

***Industrial Equipment: EQ101, EQ201, EQ103, EQ104***

***Fire Protection: FP000, FP111A, FP111B, FP111C, FP112A, FP112B, FP112C, FP 501***

***Plumbing: P000, P101A, P101B, P101C, P111A, P111B, P111C, P121A, P121B, P401, P402, P403, P404***

**HVAC:** H001, H101A, H101B, H101C, H102A, H102B, H102C, H200C, H201A, H201B, H201C, H202A, H202B, H202C, H401

**Electrical:** E001, E002, E111A, E11B, E111C, E112, E211A, E211B, E211C, E212, FA001, FA111A, FA111B, FA111C, FA112, TC001, TC111A, TC111B, TC111C

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTION TO BIDDERS.
  - 1. The following shall appear on the upper left-hand corner of the envelope:
  - 2.
    - NAME OF SUB-BIDDER: \_\_\_\_\_
    - SUB-BID FOR TRADE: MASONRY
  - 3. Each sub-bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit.
- G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

#### 1.02 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

#### 1.03 SEQUENCING

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.

- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

## **PART 2 - PRODUCTS**

### **2.01 SCAFFOLDS AND STAGING**

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
  - 1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
  - 2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
  - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
  - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

### **2.02 HOISTING MACHINERY AND EQUIPMENT**

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

## **PART 3 - EXECUTION**

### **3.01 DAILY CLEANUP**

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

END OF SECTION

SECTION 04 20 00  
UNIT MASONRY  
(FILED SUB-BID REQUIRED AS PART OF SECTION 04 00 01)

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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Building (common) brick.
4. Face Brick
5. Mortar and grout.
6. Steel reinforcing bars.
7. Masonry-joint reinforcement.
8. Ties and anchors.
9. Embedded flashing.
10. Miscellaneous masonry accessories.
11. Cavity wall insulation

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry / brick as occurs.
3. Cavity wall insulation.

C. Related Requirements:

1. Section 04 72 00 "Cast Stone Masonry" for cast stone sills and headers.
2. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.03 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.



#### 1.04 PREINSTALLATION MEETINGS

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

#### 1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
  - 1. Decorative CMUs, in the form of small-scale units.
  - 2. Brick, in the form of straps of five or more bricks.
  - 3. Colored mortar.
  - 4. Weep holes/cavity vents.
- D. Samples for Verification: For each type and color of the following:
  - 1. Decorative CMUs.
  - 2. Bricks, in the form of straps of five or more bricks.
  - 3. Colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.
  - 4. Weep holes and cavity vents.
  - 5. Accessories embedded in masonry.

#### 1.06 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.

- b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
    - c. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - d. For exposed brick, include test report for efflorescence according to ASTM C67.
    - e. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C67.
  - 2. Integral water repellent used in CMUs.
  - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 4. Mortar admixtures.
  - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 6. Grout mixes. Include description of type and proportions of ingredients.
  - 7. Reinforcing bars.
  - 8. Joint reinforcement.
  - 9. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockups for typical exterior wall sizes approximately 60 inches long by 96 inches high by full thickness, including face and backup wythes and accessories.
    - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.

- c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
  - d. Include cmu back-up, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
- 2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
- 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
- 4. Protect accepted mockups from the elements with weather-resistant membrane.
- 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
  - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
  - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.09 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
  2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

## 2.02 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
  - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

## 2.03 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

## 2.04 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units:
  - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
    - 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) Euclid Chemical Company (The); an RPM company.
      - 2) Master Builders Solutions.

3) Moxie International.

C. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi
2. Density Classification: Normal weight
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

D. Decorative CMUs: ASTM C90.

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. Westrbook Block.
  - b. A. Jandris & Sons.
  - c. York Building Products.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi
3. Density Classification: Normal weight.
4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
5. Pattern and Texture:
  - a. Standard pattern, ground-face finish.
6. Colors: selected by Architect from manufacturer's full range

2.05 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216

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. Acme Brick Company.
  - b. Belden Brick Company (The).
  - c. Endicott Clay Products Co.
2. Grade: SW
3. Type: FBS
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
6. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
8. Size (Actual Dimensions): 3 5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long, (standard 3 courses for 8" vertical)
9. Application: Use where brick is exposed unless otherwise indicated.
10. Color and Texture: As selected by Architect from manufacturer's full range..

C. Building (Common) Brick: ASTM C62, Grade SW

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi
2. Size: Match size of face brick.
3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long, (standard 3 courses for 8" vertical).
4. Application: Use where brick is indicated for concealed locations. Face brick complying with requirements for grade, compressive strength, and size indicated for building brick may be substituted for building brick.

## 2.07 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
  - 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. Davis Colors.
    - b. Euclid Chemical Company (The); an RPM company.
    - c. Solomon Colors Inc.
- E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  - 1. Colored Portland Cement-Lime Mix:
    - 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) Holcim (US) Inc.
      - 2) Lafarge North America Inc.
      - 3) Lehigh Hanson; HeidelbergCement Group.
  - 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  - 3. Pigments shall not exceed 10 percent of portland cement by weight.
- F. Aggregate for Mortar: ASTM C144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.



- 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C404.
- H. Refractory Mortar Mix: Ground fireclay or nonwater-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C199 test; or an equivalent product acceptable to authorities having jurisdiction.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 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. Euclid Chemical Company (The); an RPM company.
    - b. GCP Applied Technologies Inc.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
  - 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. Euclid Chemical Company (The); an RPM company.
    - b. GCP Applied Technologies Inc.
    - c. Master Builders Solutions.
- K. Water: Potable.

## 2.08 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Heckmann Building Products, Inc.
    - b. Hohmann & Barnard, Inc.
    - c. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch / 3/16" diameter.
4. Wire Size for Cross Rods: 0.187-inch / 3/16" diameter.
5. Wire Size for Veneer Ties: 0.187-inch / 3/16" diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

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. Hohmann & Barnard, Inc.
- b. Wire-Bond.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

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. Heckmann Building Products, Inc.
- b. Hohmann & Barnard, Inc.
- c. Wire-Bond.

2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
3. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
4. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

F. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized carbon steel continuous wire.

## 2.09 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A641/A641M, Class 1 coating.
  2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
  3. Stainless Steel Wire: ASTM A580/A580M, Type 316.
  4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
  5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
  6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.
  7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
  8. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.
- C. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch-thick steel sheet, galvanized after fabrication.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
  2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
  3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M
- G. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
  2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
  3. Fabricate wire ties from 0.25-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
  4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
  5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.

- 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) Hohmann & Barnard, Inc.
- 2) Wire-Bond.

## 2.010 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

- 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
- 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
- 3. Fabricate through-wall metal flashing embedded in masonry from stainless steel with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

- 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) Cheney Flashing Company.
- 2) Hohmann & Barnard, Inc.
- 3) Keystone Flashing Company, Inc.

- 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- 5. Solder metal items at corners.

- B. Flexible Flashing: Use the following unless otherwise indicated:

- 1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

- 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) Hohmann & Barnard, Inc.
- 2) Wire-Bond.
- 3) York Manufacturing, Inc.

- C. Application: Unless otherwise indicated, use the following:

- 1. Where flashing is indicated to receive counterflashing, use metal flashing.
- 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
- 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
- 4. Where flashing is fully concealed, use flexible flashing.

- D. Solder and Sealants for Sheet Metal Flashings:
  - 1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
  - 2. Elastomeric Sealant: ASTM C920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- F. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

## 2.011 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
  - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
    - 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) Heckmann Building Products, Inc.
      - 2) Hohmann & Barnard, Inc.
      - 3) Wire-Bond.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  - 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. Hohmann & Barnard, Inc.
- b. Keene Building Products.
- c. York Manufacturing, Inc.

2. Configuration: Provide one of the following:

- a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

## 2.012 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
- b. EaCo Chem, Inc.
- c. PROSOCO, Inc.

2. The following methods are not acceptable for cleaning the masonry:

- a. Hydrochloric Acid
- b. Muratic Acid
- c. Pressurized Water Blasting
- d. Abrasive Blasting

## 2.013 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

- 1. Do not use calcium chloride in mortar or grout.
- 2. Use portland cement-lime mortar unless otherwise indicated.
- 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

- 1. For masonry below grade or in contact with earth, use Type M.

2. For reinforced masonry, use Type S.
  3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
  4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
1. Pigments shall not exceed 10 percent of portland cement by weight.
  2. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Decorative CMU
    - b. Clay face brick.
    - c. Hollow brick.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Mix to match Architect's sample.
  2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
    - a. Clay face brick.
    - b. Hollow brick.
- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
  4. Verify that substrates are free of substances that impair mortar bond.

- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.03 TOLERANCES

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
  - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
  - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.



4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

### 3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units / brick and mortar, and wet cmu / brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
  - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
  - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

### 3.05 MORTAR BEDDING AND JOINTING

- A. Lay brick and CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
  - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units and hollow bricks with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

### 3.06 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
    - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
  2. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.
  3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.
- E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### 3.07 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
  2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.08 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
  - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.09 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

### 3.010 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. Retain any of nine subparagraphs below and revise to suit wall configurations used. Arrangement of flashing can be communicated better by detailing on Drawings rather than by relying on any of the nine subparagraphs.
  3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
  4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
  6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
  2. Space weep holes 24 inches o.c. unless otherwise indicated.
  3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products or open-head joints to form cavity vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.011 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.012 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to DIVISION 01 SPECIFICATIONS.
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.
- J. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

### 3.013 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
  - 7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 8. Clean stone trim to comply with stone supplier's written instructions.
  - 9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

### 3.014 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Crush masonry waste to less than 4 inches in each dimension.
  - 2. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 00 01  
MISCELLANEOUS AND ORNAMENTAL IRON  
FILED SUB-BID REQUIREMENTS  
(FILED SUB-BID REQUIRED)

**PART 1 - GENERAL**

1.01 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 0 – Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the filed sub-bid “Miscellaneous and Ornamental Iron” include all of the following listed Specification Sections: in their entirety:
  - 1. Section 05 00 01 – MISCELLANEOUS AND ORNAMENTAL IRON  
FILED SUB-BID REQUIREMENTS
  - 2. Section 05 50 00 – METAL FABRICATIONS
  - 3. Section 05 50 01 – MISCELLANEOUS METALS – SALT SHED
  - 4. Section 05 51 13 – METAL PAN STAIRS
  - 5. Section 05 51 19 – METAL GRATING STAIRS
  - 6. Section 05 52 13 – PIPE AND TUBE RAILINGS
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

**New Department of Public Works Facility**

**General: G000, G001, G101, G102**

**Civil: C001, C110, C200, C300, C400, C500, C600, C601, C602, C603**

**Geothermal: GT100**

**Structural: S001, S002, S003, S101, S111, S121, S131, S201, S202, S301, S302, S311, S312, S901**



***Architectural Demolition: AD101***

***Architectural: A011, A021, A031, A101, A102, A103, A104, A105, A111, A112, A113, A114, A115, A201, A211, A231, A301, A401, A402, A403, A501, A511, A601, A602, A611, A612, A621, A622, A623, A631, A701, A801, A811, A821, A823, A901, A911, A912***

***Industrial: EQ100, EQ101, EQ102***

***Fire Protection: FP000, FP001, FP002, FP111, FP112, FP501, FP502, FP600, FP700***

***Plumbing: P001, P100, P101, P102, P500, P600, P800***

***Mechanical: M001, M101, M102, M103, M104, M105, M500, M501, M700, M701***

***Electrical: E000, E001, E002, E101, E102, E111, E113, E114, E800, E801, E802***

***Fire Alarm: FA000, FA001, FA002, FAD111, FA111, FA112, FA501, FA502, FA600***

***Special Systems: SC-000, SC-100, SC-101, SC-102, SC-600, SC-701, SC-702, SC-801, T-001, T-100, T-101, T-102, T-103, T-501, T-600, T-601, T-801***

***Photovoltaics: PV101, PV601***

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTION TO BIDDERS.
  - 1. The following shall appear on the upper left hand corner of the envelope:
  - 2.
    - NAME OF SUB-BIDDER: \_\_\_\_\_
    - SUB-BID FOR TRADE: MISC. AND ORNAMENTAL IRON
  - 3. Each sub-bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit.

- G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

## 1.02 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

## 1.03 SEQUENCING

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

## PART 2 - PRODUCTS

### 2.01 SCAFFOLDS AND STAGING

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
  - 1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
  - 2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other

than those required to be

provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).

3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

## 2.02 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

## PART 3 - EXECUTION

### 3.01 DAILY CLEANUP

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

END OF SECTION

## SECTION 05 40 00

### COLD-FORMED METAL FRAMING

#### 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. Exterior non-load-bearing wall framing.
  - 2. Ceiling joist framing.

- B. Related Requirements:

- 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

##### 1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Exterior non-load-bearing wall framing.
  - 2. Vertical deflection clips.
  - 3. Single deflection track.
  - 4. Drift clips.
  - 5. Ceiling joist framing.
  - 6. Post-installed anchors.
  - 7. Power-actuated anchors.
  - 8. Sill sealer gasket.

- B. Shop Drawings:

- 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Steel sheet.
  2. Expansion anchors.
  3. Power-actuated anchors.
  4. Mechanical fasteners.
  5. Vertical deflection clips.
  6. Horizontal drift deflection clips
  7. Miscellaneous structural clips and accessories.
- E. Research Reports:
1. For nonstandard cold-formed steel framing, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
  2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

#### 1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. AllSteel & Gypsum Products, Inc.
  2. CEMCO; California Expanded Metal Products Co.
  3. ClarkDietrich.
  4. Consolidated Fabricators Corp.; Building Products Division.
  5. MarinoWARE.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
  1. Design Loads: As indicated on Drawings
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
    - b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
  3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
  4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 1/2 inch.
  5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
  1. Floor and Roof Systems: AISI S210.

2. Wall Studs: AISI S211.
  3. Headers: AISI S212.
  4. Lateral Design: AISI S213.
- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

## 2.03 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As required by structural performance
  2. Coating: G90 or equivalent
- B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance
  2. Coating: G90

## 2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch
  2. Flange Width: 2 inches
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch
  2. Flange Width: 1-1/4 inches
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
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. ClarkDietrich.

- b. Steel Construction Systems.
  - c. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0677 inch
  - 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.05 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 20 MILS, minimum thickness.
  - 2. Flange Width: 2 inches
  - 3. Section Properties: Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel studs
  - 2. Flange Width: 1-1/4 inches
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
  - 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. ClarkDietrich.
    - b. Steeler, Inc.
    - c. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: 20 MILS, minimum thickness.



2. Flange Width: 1 inch plus the design gap for one-story structures
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.06 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch
  2. Flange Width: 2 inches minimum.

## 2.07 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch
  2. Flange Width: 2 inches minimum.

## 2.08 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Foundation clips.
  7. Gusset plates.
  8. Stud kickers and knee braces.
  9. Joist hangers and end closures.
  10. Hole-reinforcing plates.
  11. Backer plates.

## 2.09 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

- B. Anchor Bolts: ASTM F1554, Grade 55, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
  - 1. Uses: Securing cold-formed steel framing to structure.
  - 2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor or adhesive anchor.
  - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
  - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

## 2.010 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.
- F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-

film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

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. Polyguard Products, Inc.
2. Physical Properties:
  - a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
  - b. Low-Temperature Flexibility: Pass at minus 25 deg FASTM D146/D146M.
  - c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96/E96M, Method B.
  - d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

## 2.011 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  1. Fabricate framing assemblies using jigs or templates.
  2. Cut framing members by sawing or shearing; do not torch cut.
  3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
  4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
  1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.03 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
  - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

#### 3.04 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  1. Stud Spacing: As indicated on Drawings
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  1. Install single deep-leg deflection tracks and anchor to building structure.
  2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
  4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at 96-inch centers
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.05 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.06 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

### 3.07 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.08 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 50 00  
METAL FABRICATIONS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 05 00 01)

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, Furnish and Installing. Work includes but is not limited to the following:

- A. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Slotted channel framing.
- C. Shelf angles.
- D. Metal bollards.
- E. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- F. Metal ladders, various types (Includes interior and exterior ladders).
- G. Mezzanine guardrails and gates.
- H. Flush cover plates below Mezzanine gates.
- I. Metal downspout boots.
- J. Mezzanine Edge Channels
- K. Hose Reel support framing for fluid distribution system and vehicle exhaust system.
- L. Hot-Dipped galvanized angles, plates, and supports for sectional door tracks, springs, and motors for doors and equipment specified under Section 08 36 13 SECTIONAL DOORS.
- M. Floor grates at Wasy Bay and Vehicle Storage
- N. Support brackets for communication antennae.
- O. Furnish and install galvanized steel racking system to support Solar PV equipment as shown on the drawings.
- P. Structural Supports for miscellaneous attachments
- Q. Column closure plates at steel framing through mezzanine slabs.
- R. Interior stairs are specified in 05 51 13 METAL PAN STAIRS
- S. Galvanized exterior catwalk are specified in 05 51 19 METAL GRATING STAIRS
- T. Railings are specified in 05 52 13 – PIPE AND TUBE RAILINGS
- U. All other non-specified metal work generally performed by the Miscellaneous Metals trade, and which are not otherwise provided under Section 05 40 00 – COLD-FORMED METAL FRAMING.

- B. Products furnished, but not installed, under this Section include the following:



- A. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- B. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Interior frames and grates for installation by the General Contractor.
- D. Exterior Bollards for installation by the General Contractor.

C. Related Requirements:

- A. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
  - A. Nonslip aggregates and nonslip-aggregate surface finishes.
  - B. Fasteners.
  - C. Shop primers.
  - D. Shrinkage-resisting grout.
  - E. Slotted channel framing.
  - F. Metal bollards.
  - G. Metal ladders, various types
  - H. Metal downspout boots.
  - I. Mezzanine Edge Channels
  - J. Hose Reel support framing for fluid distribution system and vehicle exhaust system.
  - K. Hot-Dipped galvanized angles, plates, and supports for sectional door tracks, springs, and motors for doors and equipment specified under Section 08 36 13 SECTIONAL DOORS.
  - L. Floor grates at Wasy Bay and Vehicle Storage
  - M. Support brackets for communication antennae.
  - N. Structural Supports for miscellaneous attachments
  - O. Column closure plates at steel framing through mezzanine slabs.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

- A. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Shelf angles.
- C. Loose steel lintels.
- D. Metal ladders, various types
- E. Metal downspout boots.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research Reports: For post-installed anchors.

#### 1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - B. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - C. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

#### 1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, registered in the state of the project, to design ladders.
  - 1. Structural Performance of Aluminum Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

- A. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

## 2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.
- E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled-Stainless Steel Floor Plate: ASTM A793.
- G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. Zinc-Coated Steel Wire Rope: ASTM A741.
  - A. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- J. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
  - A. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft. zinc coating.
  - A. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.
- L. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - A. Size of Channels: As indicated

- B. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
- C. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33; 0.0677-inch minimum thickness; hot-dip galvanized after fabrication.
- M. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- N. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- O. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- P. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- Q. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- R. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- S. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or UNS No. C84400 (lead semired brass).
- T. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- U. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent lead nickel bronze).

## 2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - A. Provide stainless steel fasteners for fastening stainless steel.
  - B. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
  - A. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - A. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  - B. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

#### 2.04 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 90 00 "Painting".
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - A. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- I. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - B. Obtain fusion without undercut or overlap.
  - C. Remove welding flux immediately.
  - D. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - A. Fabricate units from slotted channel framing where indicated.
  - B. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
  - A. Provide bearing plates welded to beams where indicated.
  - B. Drill or punch girders and plates for field-bolted connections where indicated.
  - C. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
  - A. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
  - B. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.
- F. Galvanize miscellaneous framing and supports where indicated.
- G. Prime miscellaneous framing and supports with zinc-rich primer indicated.

## 2.07 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
  - A. Provide mitered and welded units at corners.
  - B. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.08 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - A. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer.

## 2.09 METAL BOLLARDS

- A. Fabricate metal bollards from steel shapes, as indicated.
  - A. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
  - B. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Primed hot dipped galvanized steel bollards

## 2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

## 2.11 METAL LADDERS

- A. General:
  - A. Comply with ANSI A14.3
- B. Aluminum Ladders:



- 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:
  - a. Halliday Products.
  - b. O'Keeffe's Inc.
  - c. Precision Ladders, LLC.
- B. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
- C. Space siderails 24 inches apart unless otherwise indicated.
- D. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
- E. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
- F. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
- G. Provide platforms as indicated fabricated from pressure-locked aluminum bar supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch in least dimension.
- H. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.

## 2.12 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
  - 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) Halliday Products.
    - 2) O'Keeffe's Inc.
    - 3) Precision Ladders, LLC.
  - B. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
  - C. Fabricate ships' ladders including railings from aluminum.
  - D. Fabricate treads and platforms from pressure-locked aluminum bar grating. Limit openings in gratings to no more than 1/2 inch in least dimension.
  - E. Fabricate treads and platforms from rolled-aluminum-alloy tread plate.

## 2.13 MEZZANINE SLIDING GATE

- A. Provide 3-Rail, 8'-0" clear access Sliding Gates where indicated. Fabricated of Hollow Structural Tubing 1 ½" x 1 ½" x 16GA with Powder Coated finish. To be provided with Padlock Hasp, Receiver Bracket.
  - a. Manufacturers: Subject to compliance with basis of design product by, (Cogan Wire and Metal Products Ltd.), available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - 1) Cogan Wire and Metal Products Ltd.
    - 2) CAI Safety Systems, Inc.
    - 3) Tractel Ltd.
  - B. Sliding gate shall have curved top ends (corners) with a 5" minimum radial corner at the intersection of top rail and jambs.
  - C. Gate to be captured by top and bottom rails.
  - D. Sliding gate to run on heavy-duty, ball bearing casters.

## 2.14 METAL DOWNSPOUT BOOTS

- 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:
  - a. Downspout transition boot: Factory finished, 11 gauge, custom color to match downspout equal to Piedmont Pipe "Type SO".
- B. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- C. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
  - 1. Outlet: Vertical, offset to discharge into pipe. Coordinate with underground drainage.
- D. Prime cast-iron downspout boots with zinc-rich primer.
- E. Height: 32-inches
- F. Downspout Boot Dimensions – 5-inches x 6-inches

## 2.15 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## 2.16 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - A. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - A. Shop prime with primers specified in Section 09 90 00 "Painting" unless zinc-rich primers are indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:
  - A. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - B. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - C. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
  - D. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - A. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.18 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## 2.19 CAST IRON GRATING

- A. Cast Iron Grating:

1. Loading: "Heavy Duty," highway traffic loads, exceeding AASHTO H-20/HS-20 specifications (wheel loads of 16,000 pounds with a tire contact area of 8 inches by 20 inches) with 40,000 pounds proof load per AASHTO M-306.
  2. Bar spacing, depth and thickness: As engineered by Fabricator.
  3. Grating Size: As indicated on Drawings.
  4. Traffic Surface: Plain.
  5. Finish: Acid-resistant epoxy coating.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. U.S. Foundry, Medley FL.
  2. MiFab Inc., Chicago, IL
  3. Neehah Foundry, Neenah, WI.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - B. Obtain fusion without undercut or overlap.
  - C. Remove welding flux immediately.
  - D. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  - A. Cast Aluminum: Heavy coat of bituminous paint.
  - B. Extruded Aluminum: Two coats of clear lacquer.

### 3.02 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for coiling doors securely to, and rigidly brace from, building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  - A. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.
  - A. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### 3.03 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
  - A. Do not fill removable bollards with concrete.
- B. Misc and Ornamental Iron Filled Subcontractor shall anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
  - A. Embed anchor bolts at least 4 inches in concrete.
- C. General Contractor shall anchor / install bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

- D. General Contractor shall fill bollards solidly with concrete, mounding top surface to shed water.
- A. Do not fill removable bollards with concrete.

### 3.04 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.05 REPAIRS

- A. Touchup Painting:
  - A. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
  - B. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 – “Painting”
- B. welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05 50 01  
MISCELLANEOUS METALS – SALT SHED  
(FILED SUB-BID REQUIRED AS PART OF SECTION 05 00 01)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

All Work under this Section shall be performed in accordance with the Drawings and the provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division I—General Requirements of these Specifications.

1.02 SCOPE OF WORK

Work under this section shall include truss bearing plates, truss connector plates, joist hangers, angles, bolts, washers, nails, ***H-clips*** (*for ply under truss*), ***hurricane straps***, structural steel fasteners, and bollards.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00, Submittals.
- B. Truss Bearing Plate Assembly: submit shop drawings for approval.
- C. Structural Steel Fasteners: submit manufacturer's specifications and technical information.

PART 2 – PRODUCTS

2.01 TRUSS BEARING PLATE ASSEMBLY

Truss bearing plate assembly, bolts, and washers shall be AISI Type 304 stainless steel as detailed on Drawings.

2.02 TRUSS CONNECTOR PLATES

*If no LT:*

- A. Truss connector plates shall be galvanized steel, epoxy coated as described in Section 09900.

*if LT:*

- A. In the salt storage area: galvanized steel, epoxy coated as described in Section 09900.
- B. In the lean-to: galvanized steel.

2.03 JOIST HANGERS

*if end entrance:*

- A. Joist hangers shall be JUS26TZ 18 gauge slant nail joist hangers with triple zinc coating by USP Structural Connectors ([www.USPconnectors.com](http://www.USPconnectors.com), 1-800-328-5934).

## 2.04 ANGLES

Angles connecting endwall knee braces to the top and bottom chords of trusses shall be USP Structural Connectors field adjustable framing angles, MP series, JA5-HDG, 14 gauge hot dip galvanized steel, 2.5 x 2.5 x 5 inches.

## 2.05 BOLTS AND WASHERS

All bolts (other than those used for the truss bearing plates) and washers shall be made of ASTM A-307 steel, and shall be hot dip galvanized.

## 2.06 HURRICANE STRAPS

Hurricane straps fastening lean-to trusses to beams shall be Simpson Strong-Tie model MTS- 12, galvanized, by Simpson Strong-Tie Company, Inc., 800-999-5099, [www.strongtie.com](http://www.strongtie.com), or approved equal, as shown on Drawings.

## 2.07 NAILS

A. Materials: All nails, other than roofing nails, shall be ring-shank, double hot dipped, galvanized coated steel.

B. Sizes

|                | <u>Location</u>                                                 | <u>Size</u> | <u>Remarks</u>            |
|----------------|-----------------------------------------------------------------|-------------|---------------------------|
|                | stress skin panel frames and blocking                           | 16d         |                           |
|                | plywood skins to panels                                         | 8d          |                           |
|                | interior liner to panels                                        | 8d          |                           |
|                | battens to exterior panels                                      | 8d          |                           |
|                | fasteners for trusses                                           | 5/16"       | GRK fasteners (see below) |
|                | upper hip purlins (joist hangers)                               | 8d          |                           |
|                | x-bracing, lateral bracing, lower hip purlins, girts, and jambs | 16d         |                           |
|                | angles fastening endwall knee braces to trusses                 | *           | *as per manufacturer      |
| <b>if OD**</b> | <b>overhead door header</b>                                     | <b>60d</b>  |                           |
|                | exterior siding                                                 | 6d          | do not use power nails    |
|                | roofing nails                                                   | *           | *as per manufacturer      |
|                | roof deck                                                       | 8d          |                           |
| <b>if LT</b>   | Simpson Strong-Ties                                             | *           | *as per manufacturer      |

## 2.08 STRUCTURAL STEEL FASTENERS

Structural steel screws shall be 5/16" RSS™ LTF Timber Frame Fasteners with washer type heads and reinforced shoulders of case-hardened steel with Climatek™ coating by GRK Fasteners, Thunder Bay, ON, Canada, 800-263-0463, 807-474-4300, [grk@grkfasteners.com](mailto:grk@grkfasteners.com), or approved equal.



2.08 BOLLARDS

Bollards (door jamb guard posts) shall consist of minimum 6 OD standard weight steel structural pipe, filled with concrete. Form concrete crown at top of bollard.

PART 3 – EXECUTION

3.01 NAILING

- A. Do not use power nails to apply Duratemp exterior siding.
- B. Endwall siding shall be attached to girts with nails 6" on center.
- C. Roof sheathing shall be attached to purlins with galvanized 8d nails 6" on center.
- D. Splice members shall be attached to endwall columns with nails 6" on center, staggered.

3.02 STRUCTURAL STEEL FASTENERS

Size, number, and location shall be as shown on Drawings.

3.03 BOLLARDS

Locations, dimensions, and depth of footings and bollards shall be as shown on Drawings.

END OF SECTION

SECTION 05 51 13  
METAL PAN STAIRS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 05 00 01)

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. Preassembled steel stairs with concrete-filled treads.
  - 2. Railings and guards attached to metal stairs.
  - 3. Handrails attached to walls adjacent to metal stairs.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
  - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
  - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
  - 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
  - 1. Prefilled metal-pan-stair treads.
  - 2. Shop primer products.

3. Nonslip-aggregate concrete finish.
4. Handrail wall brackets.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
  1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
  2. Protect steel members and packaged materials from corrosion and deterioration.
  3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
    - a. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs, railings and guards including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft..
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
  - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### 2.02 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- C. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40 for handrails, Schedule 80 for guardrails, vertical posts & horizontal members), unless another grade and weight are required by structural loads.

- 1. Provide galvanized finish for exterior installations and where indicated.

## 2.03 FASTENERS

- A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

- 1. Select fasteners for type, grade, and class required.

- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

- 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs and/or stairs indicated to be galvanized.

- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

- 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.04 MISCELLANEOUS MATERIALS

- A. Handrail Wall Brackets: Cast aluminum, center of rail 1-1/2 inches clear from face of wall to face of railing.

- 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. Blum, Julius & Co., Inc.
    - b. The Wagner Companies.

- B. Welding Electrodes: Comply with AWS requirements.
- C. Shop Primers: Provide primers that comply with Section 09 90 00, "PAINTING".
- D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- E. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-A, Level 1, and compatible with topcoat.
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- J. Prefilled Concrete Treads:
  - 1. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
  - 2. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
  - 3. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, galvanized steel, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated on Drawings.
  - 4. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
    - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- K. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.05 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
  - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  - 2. Locate joints where least conspicuous.
  - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
  - 4. Provide weep holes where water may accumulate internally.

## 2.06 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Service Class, unless more stringent requirements are indicated.
- B. Stair Framing:

1. Fabricate stringers steel channels as indicated on Drawings.
    - a. Stringer Size: As required to comply with "Performance Requirements" Article
    - b. Provide closures for exposed ends of channel and rectangular tube stringers.
    - c. Finish: Shop primed unless exterior or noted as galvanized.
  2. Construct platforms of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
    - a. Provide closures for exposed ends of channel and rectangular tube framing.
    - b. Finish: Shop primed unless exterior or noted as galvanized.
  3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
  4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
    - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
  5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
  2. Steel Sheet: Galvanized-steel sheet.
  3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
  4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
  5. Shape metal pans to include nosing integral with riser.
  6. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
  7. Provide epoxy-resin-filled treads, reinforced with glass fibers, with non-slip-concrete aggregate finish to tread surface.
  8. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
    - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.
- D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.097 inch.



1. Steel Sheet: Uncoated, hot-rolled steel sheet unless otherwise indicated.
2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

## 2.07 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

## 2.08 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
  1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
  1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
    - a. Clean bottom surface of plates.
    - b. Set plates for structural members on wedges, shims, or setting nuts.
    - c. Tighten anchor bolts after supported members have been positioned and plumbed.
    - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
    - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
      - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
      - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
  1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  3. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

### 3.03 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
  1. Space posts at spacing indicated or, if not indicated, as required by design loads.
  2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
  3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
  4. Secure posts, rail ends, and guard ends to building construction as follows:

- a. Anchor posts to steel by welding to steel supporting members.
  - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.
- B. Install railing gates level, plumb, and secure for full opening without interference.
  - 1. Attach hardware using tamper-resistant or concealed means.
  - 2. Adjust hardware for smooth operation.
- C. Attach handrails to wall with wall brackets.
  - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
  - 2. Secure wall brackets to building construction as follows:
    - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
    - b. For hollow masonry anchorage, use toggle bolts.
    - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
    - d. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
    - e. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
    - f. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

### 3.04 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00, "PAINTING".
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05 51 19

METAL GRATING STAIRS  
(FILED SUB-BID REQUIRED AS PART OF 05 00 01)

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. Exterior Industrial Class stairs with steel-grating treads. (Exterior Catwalk)
  - 2. Steel railings and guards attached to metal stairs.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
  - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
  - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
  - 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
  2. Protect steel members and packaged materials from corrosion and deterioration.
  3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
    - a. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design stairs, railings, and guards, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft..
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
  - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Component Importance Factor: 1.5

### 2.02 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- D. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
- E. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.
- F. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:
  - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
  - 2. 6061-T1, for grating crossbars.
- G. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- H. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 80), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.

## 2.03 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
  - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
  - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.04 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting"
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-B, Level 1 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A780/A780M and compatible with paints specified to be used over it.
- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

## 2.05 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  1. Join components by welding unless otherwise indicated.
  2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
  1. Disassemble units only as necessary for shipping and handling limitations.
  2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  2. Remove sharp or rough areas on exposed surfaces.



- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
  - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  - 2. Locate joints where least conspicuous.
  - 3. Fabricate joints that are exposed to weather in a manner to exclude water.
  - 4. Provide weep holes where water may accumulate internally.

## 2.06 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
  - 1. Fabricate stringers of steel channels.
    - a. Stringer Size: As required to comply with "Performance Requirements" Article
    - b. Provide closures for exposed ends of channel stringers.
    - c. Finish: Galvanized
  - 2. Construct platforms and tread supports of steel or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
    - a. Provide closures for exposed ends of channel framing.
    - b. Finish: Galvanized.
  - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
  - 1. Fabricate treads and platforms from pressure-locked aluminum grating with 1-by-1/8-inch bearing bars at 7/16 inch o.c. and crossbars at 4 inches o.c.

- a. Surface: Plain
  - b. Finish: Galvanized
- 2. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections.
  - a. Secure treads to stringers with bolts.
- 3. Fabricate grating platforms with nosing matching that on grating treads.
  - a. Secure grating to platform framing with bolts.
- D. Risers: Open
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
  - 1. Material and Finish: Steel plate to match finish of other steel items.
  - 2. Fabricate to dimensions and details indicated.

## 2.07 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

## 2.08 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
  - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
  - 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.
    - a. Clean bottom surface of baseplates.
    - b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
    - c. After stairs have been positioned and aligned, tighten anchor bolts.
    - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
    - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
      - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
      - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  - 3. Comply with requirements for welding in "Fabrication, General" Article.

### 3.03 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
  - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
  - 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.

4. Secure posts, rail ends, and guard ends to building construction as follows:
  - a. Anchor posts to steel by welding or bolting to steel supporting members.
  - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

#### 3.04 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting"
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05 52 13  
PIPE AND TUBE RAILINGS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 05 00 01)

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. Steel railings.

B. Related Requirements:

- 1. Section 05 51 19 "Metal Grating Stairs" for steel tube railings associated with metal pan stairs.

1.03 COORDINATION:

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. 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.

1.04 ACTION SUBMITTALS:

A. Product Data:

- 1. Manufacturer's product lines of mechanically connected railings.
- 2. Fasteners.
- 3. Post-installed anchors.
- 4. Handrail brackets.
- 5. Shop primer.
- 6. Intermediate coats and topcoats.
- 7. Bituminous paint.
- 8. Nonshrink, nonmetallic grout.
- 9. Anchoring cement.
- 10. Metal finishes.
- 11. Paint products.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
  - 2. Fittings and brackets.
  - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    - a. Show method of connecting and finishing members at intersections.
- E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS:

- A. Qualification Data: For delegated-design professional engineer
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless-steel products, certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.06 QUALITY ASSURANCE:

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.08 FIELD CONDITIONS:

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS, GENERAL:

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.03 STEEL RAILINGS:

- 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. Kee Safety, Inc.
  - 2. R & B Wagner, Inc.
  - 3. VIVA Railings, LLC.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Tubing: ASTM A500/A500M (cold formed)
- D. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- E. Plates, Shapes, and Bars: ASTM A36/A36M.
- F. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.04 FASTENERS:

- A. Fastener Materials:
  - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
  - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
  - 3. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
  - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
  - 3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.



- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
  - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.05 MISCELLANEOUS MATERIALS:

- A. Handrail Brackets: Handrails from edge of handrail 2-1/4-inches from face of wall that railing attaches to.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
  - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting"
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- I. Intermediate Coats and Topcoats: Provide products that comply with Section 09 90 00 "Painting".
- J. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- K. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- L. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- M. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- N. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.06 FABRICATION:

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
  - 1. Clearly mark units for reassembly and coordinated installation.
  - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
  - 1. Provide weep holes where water may accumulate.
  - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. 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 flux immediately.
  - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
  - J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
    - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
  - K. Form changes in direction as follows:
    - 1. By bending to smallest radius that will not result in distortion of railing member.
  - L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
  - M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
  - N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
  - O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
    - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
  - P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
    - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
    - 2. Coordinate anchorage devices with supporting structure.
  - Q. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- 2.07 STEEL AND IRON FINISHES:
- A. Galvanized Railings:
    - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
    - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
    - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner, and as follows.
1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3:
1. Exterior Railings: SSPC-SP 6/NACE No. 3.
  2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
  3. Other Railings: SSPC-SP 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with primers specified in Section 09 90 00 "Painting" unless zinc-rich primer is indicated.
  2. Do not apply primer to galvanized surfaces.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

#### 3.02 INSTALLATION, GENERAL:

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
  2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
  3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.03 RAILING CONNECTIONS:

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

### 3.04 ANCHORING POSTS:

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

- D. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
  - 2. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
  - 3. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.

### 3.05 ATTACHING RAILINGS:

- A. Anchor railing ends to concrete and masonry with flanges connected to brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

### 3.06 REPAIR:

- A. Touchup Painting:
  - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 "Painting".

### 3.07 CLEANING:

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.08 PROTECTION:

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 06 10 00  
ROUGH CARPENTRY

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. Framing with dimension lumber.
  - 2. Wood blocking, cants, and nailers.
  - 3. Wood furring and grounds.
  - 4. Wood sleepers.
  - 5. Utility shelving.
  - 6. Plywood backing panels.

1.03 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include



physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

#### 1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

#### 1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
  3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, Furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Treatment shall not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.[For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
  - 1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
  - 1. Concealed blocking.
  - 2. Framing for non-load-bearing partitions.
  - 3. Roof construction.
  - 4. Plywood backing panels.

## 2.04 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
  2. Nailers.
  3. Cants.
  4. Furring.
  5. Grounds.
  6. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 in any of the following species:
1. Hem-fir (north); NLGA.
  2. Mixed southern pine or southern pine; SPIB.
  3. Spruce-pine-fir; NLGA.
  4. Hem-fir; WCLIB or WWP.
  5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWP.
  6. Western woods; WCLIB or WWP.
  7. Northern species; NLGA.
  8. Eastern softwoods; NeLMA.
- C. Utility Shelving: Lumber with 15 percent maximum moisture content of any of the following species and grades:
1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWP.
  2. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  3. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWP.
  4. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWP.
- D. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWP.
  3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWP.
  4. Eastern softwoods; No. 2 Common grade; NeLMA.
  5. Northern species; No. 2 Common grade; NLGA.
  6. Western woods; Construction or No. 2 Common grade; WCLIB or WWP.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.05 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## 2.06 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

## 2.07 METAL FRAMING ANCHORS

- 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. Cleveland Steel Specialty Co.
  - 2. Simpson Strong-Tie Co., Inc.
  - 3. USP Structural Connectors.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.
1. Use for exterior locations and where indicated.

## 2.08 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - 2. ICC-ES evaluation report for fastener.
- M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  - 1. Comply with approved fastener patterns where applicable.
  - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
  - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

### 3.02 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.03 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

### 3.04 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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SECTION 06 10 01  
ROUGH CARPENTRY – SALT SHED

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

All Work under this Section shall be performed in accordance with the Drawings and the provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division I—General Requirements of these Specifications.

1.02 SCOPE OF WORK

- A. This section shall cover the labor and material necessary to furnish and install the following:

1. Wood barrier wall and liner
2. Rough framing and sheathing
3. Prefabricated wood trusses
4. Hi-Arch Gambrel™ frames
5. Exterior wood siding and wood trim

1.03 QUALITY ASSURANCE

All lumber shall be grade-marked with the Association stamp, showing species, grade, and mill number; lumber shall be kiln-dried and marked as such. For southern pine, the term Association refers to the Southern Pine Inspection Bureau.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00, Submittals.
- B. Pressure Treated Members: submit certificate of treatment from lumber supplier, showing sizes of members and treatment for each.
- C. Plywood: American Plywood Association (APA) stamp should be visible on all plywood to verify grade.
- D. Trusses:
1. Submit stamped truss design drawings and design calculations, provided by the truss manufacturer, and stamped by an engineer licensed in the State of MA.
  2. Trusses shall be designed for loading requirements as shown on Drawings.
  3. The increase in unit stress for short term loading shall be a maximum of 15%, or in accordance with state and local regulations.
  4. Submittals must show the following:

- a. Space diagram with panel point loading
- b. Force diagram
- c. Truss configuration, showing slope and span
- d. All joint details indicating connector plate size and position
- e. Size and grade of lumber (to be southern pine)
- f. Camber to allow for dead load deflection and connector construction.
- g. Design calculations for truss member sizes. In no case shall members of smaller size than those shown on the drawings be used.

## PART 2 – PRODUCTS

### 2.01 GENERAL

#### A. Pressure Treated Components

1. Pressure treatment for components not in ground contact shall be water-borne CCA 0.40 treatment in accordance with AWP Standard U1 to the requirements of Use Category UC4A. This applies to items such as stress skin panel studs, beams, battens, plywood skins and liner.
2. Pressure treatment for components in ground contact shall be water-borne CCA 0.60 treatment in accordance with AWP Standard U1 to the requirements of Use Category UC4B. This applies to items such as wood columns and braces, and 6x6 grade beam members at the base of the crib wall.
3. Cut ends of all members greater than 2” nominal thickness which are required to be pressure treated shall be painted with Sherwin Williams WoodScapes® Exterior Polyurethane Semi-transparent Stain, A15T00005, tinted #3535 Foliage, or approved equal. Product is available through Sherwin-Williams, 1-800-424-5837, <http://www.sherwin-williams.com>.
4. Moisture Content: Any wood components with a nominal thickness of 2 or less shall have a moisture content not to exceed 19% when installed.

### 2.02 TREATED WOOD BARRIER WALL

#### A. Description

The barrier wall, as detailed on the Drawings, shall be a composite retaining wall consisting of 4' x 16' (or sized as required) wood stress-skin panels, spanning between wood columns and braces located 8'-0 on center which support the roof trusses. A wood liner shall be applied to the interior surface of the barrier wall.

#### B. Materials

1. Wood Columns and Braces shall be pressure-treated kiln-dried #2 or better southern pine.
2. Shop Fabricated Stress Skin Panels
  - a. Exterior (perimeter) panel studs shall be 2x6 pressure treated wood studs,

- #2 southern pine.
- b. Interior panel studs shall be 2x6 non-pressure treated wood studs, #2 southern pine, 8 o.c.
- c. Blocking: 4x6 solid wood blocking at points of attachment to columns, 8' o.c.; see Drawings for details.
- d. Exterior panel skin: 1/2 pressure treated exterior structural plywood, grade APA-AC or APA-BC, sanded.
- e. Interior panel skin: 3/4 pressure treated CDX plywood.
- f. Nails fastening the exterior and interior plywood skins to the panels shall be galvanized 8d nails as indicated in Section 05500, Miscellaneous Metals.
- g. Adhesive (glue) shall be Titebond GREENchoice heavy duty construction adhesive by Franklin International, Columbus, OH, 1-800-877-4583.
- h. Bolts fastening the panels to the columns shall be hot dip galvanized lag bolts, recessed as shown on Drawings.

3. Interior Plywood Liner

- a. Liner shall consist of 3/4 pressure treated CDX plywood.
- b. Nails fastening the interior liner to the panels shall be galvanized 8d nails, as shown on Drawings.

4. Battens

- a. Battens for application over exterior horizontal panel joints shall be 1x2 pressure treated #2 southern pine. Top edges of battens shall chamfered at a 45-degree angle to provide drainage away from the panel face.
- b. Nails for battens shall be galvanized 8d nails.

2.03 ROUGH FRAMING AND SHEATHING

- A. Rough framing includes such lumber as door jambs, joists, rafters, studs, plates, furring, backing, copings, fascias, curbs, framing, grounds, sleepers, blocking, etc.
- B. All lumber for rough carpentry shall be construction-grade lumber, with extreme fiber stress of not less than 1,200 psi.
- C. Wood columns installed above the crib wall shall be 6x6 pressure-treated kiln-dried #1 or better southern pine.
- D. Wood columns supporting the lean-to shall be pressure-treated kiln-dried #2 or better southern pine.
- E. Vertical entranceway framing members shall be pressure-treated kiln-dried #2 or better southern pine.
- F. Roof sheathing shall be 5/8 thick four-ply CDX plywood, or approved equal, where called for on drawings, approved by the American Plywood Association, and fastened with galvanized 8d nails 6 on center.

2.04 PREFABRICATED WOOD TRUSSES

- A. Trusses shall be fabricated from lumber as designated by truss manufacturer (grade and size of members).
- B. All load bearing lumber and all components of roof trusses shall have 1,200-psi minimum working stress at 19% maximum moisture content.
- C. Toothed truss connector plates shall be Alpine or approved equal, galvanized steel, treated as specified under Section 09 91 00, Painting – Salt Shed.
- D. The net area of connector plate shall not include the area within 1/2 from the edge or end of the connected member.
- E. The plate at the peak must be capable of carrying one half the design stress in the member.
- F. All other plates must carry the full design stress across the joint.

## 2.05 HI-ARCH GAMBREL™ FRAMES

- A. The Hi-Arch Gambrel™ truss frames are to be constructed of prefabricated wood trusses tied together with structural steel fasteners as shown on the drawings.
  - 1. Prefabricated wood trusses are specified in Paragraph 2.3 above.
  - 2. Structural steel fasteners are specified in Section 05500, Miscellaneous Metals.

## 2.06 EXTERIOR WOOD SIDING AND WOOD TRIM

- A. Furnish and install where shown on Drawings 19/32" exterior grade rough-sawn siding with shiplap vertical edges and grooves 8 o.c., product to be Duratemp by Roseburg Forest Products, Roseburg, OR (800-245-1115, [www.roseburg.com](http://www.roseburg.com)), or approved equal.
- B. Panels to be 4' x 8' or 4' x 10' as required.
- C. Provide Z-molding at all horizontal joints.
- D. Wood trim to be 1x6 southern pine as shown on Drawings.

## PART 3 – EXECUTION

### 3.01 GENERAL

Painting of Cut Ends of Pressure-Treated Members: for number of coats and other application directions, follow recommendations in manufacturer's literature.

### 3.02 TREATED WOOD BARRIER WALL

- A. Fabrication of Panels
  - 1. Panels, including studs, beams, and plywood skins, shall be shop manufactured.
  - 2. Reinforcement: panels shall be reinforced with solid wood blocking as shown on

Drawings.

3. Both the exterior and interior plywood skins shall be glued and nailed to the panel frame as shown on Drawings.
4. A continuous bead of adhesive shall be applied to the entire perimeter frame and to the face of each stud, to which panel skins are to be attached. Spot application is not adequate.

B. Installation

1. Stress Skin Panels: The panels shall be fastened to the columns with galvanized lag bolts, recessed as shown on Drawings.
2. Interior Liner: The interior liner shall be field applied to the interior surface of the barrier wall and shall be nailed only as shown on Drawings. Carefully follow Drawings for liner layout (staggering panel joints) and for nailing pattern.

3.03 ROUGH FRAMING AND SHEATHING

- A. All framing shall be carefully and accurately laid out, shall be erected and secured in accordance with best building practice, and shall be of size and spacing indicated on the drawings.
- B. Roof sheathing shall be attached to purlins with galvanized 8d nails 6" on center.

3.04 PREFABRICATED WOOD TRUSSES

- A. Trusses to be shop assembled; all wood members shall have full bearing.
- B. Plates shall be positioned as shown on approved shop drawings, and pressed into wood members so that full penetration of the teeth is obtained without crushing surfaces of wood.
- C. All connections shall be made with connectors as required to transmit the stresses fully. Connectors shall conform to Truss Plate Institute Design Specifications for Light Metal Connected Wood Trusses-TP-166 .
- D. Wood members shall be designed in accordance with National Design Specifications for wood construction by the NFPA for stress graded lumber.
- E. Trusses shall be constructed true to line and dimensions within a tolerance of 1/4 for length and 1/8 for height.
- F. All trusses to be stored at the job site in a manner to prevent warping or twisting of trusses.

3.05 RIGID HI-ARCH GAMBREL™ FRAMES

- A. Designate an area adjacent to the building as a staging area. The truss frames will then be laid out in that area.
- B. Fabricate the trusses into frames as follows:
  1. The top truss or trusses (as applicable), having a horizontal bottom chord, are to be

- sandwiched between two trusses setting diagonally on each side.
2. The trusses are to be bolted into a frame and made rigid by the use of structural steel fasteners, installed where shown on the drawings, in accordance with manufacturer's instructions, and using equipment as recommended or mandated by connector manufacturer. For truss-to-truss connections, bolts alone are not acceptable.
  3. Where the side trusses are separated by 1-1/2 , 2x4 spacers shall be installed intermittently or continuously. Where the side trusses are separated by 3 , two 2x4 spacers shall be installed intermittently or continuously.
  4. After Hi-Arch Gambrel truss frames have been assembled, any truss connector plates which remain exposed on the exterior faces of the trusses shall be painted with epoxy coating as specified in Section 09 91 00
- C. Furnish and install temporary bracing and stiffeners as needed during erection process, in accordance with the most current version of Bracing Wood Trusses published by the Truss Plate Institute.
- D. Trusses shall be erected in locations and at spacings shown on Drawings. Provide complete lateral bracing during erection, and permanent lateral bracing as shown on Drawings, or as required by truss manufacturer.
- E. See Section 05 50 01, Miscellaneous Metals – Salt Shed, and Drawings for base plate details.
- F. Any trusses that are damaged during delivery or erection shall be replaced at no extra cost to the Owner.
- 3.06 EXTERIOR WOOD SIDING AND WOOD TRIM
- A. Use 6d galvanized casing nails for application.
  - B. Power nails are not to be used on exterior siding.

END OF SECTION

## SECTION 06 16 00

### SHEATHING

#### 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. Wall sheathing.
  - 2. Underlayment.
  - 3. Sheathing joint and penetration treatment.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry"

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
  - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
  - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  - 5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

C. Field quality-control reports.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

#### 2.02 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

#### 2.03 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.



- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing

## 2.04 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified.[ For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
  - 1. Interior Roof sheathing.
  - 2. Elec Panel Backer Panels
  - 3. Exposed wall sheathing on mezzanine and other areas throughout the building.

## 2.05 WALL SHEATHING (HIDDEN)

- A. Plywood Sheathing: Exposure 1, Structural I.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 1/2 inch.

## 2.06 WALL SHEATHING (EXPOSED)

### A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16
2. Nominal Thickness: Not less than 5/8 inch.
3. Fire Treated
4. BC Grade Plywood.

## 2.07 INTERIOR ROOF SHEATHING

### A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16
2. Nominal Thickness: Not less than 1/2 inch.
3. Fire Treated

## 2.08 FASTENERS

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

1. For roof and wall sheathing, provide fasteners of Type 304 stainless steel.

### B. Nails, Brads, and Staples: ASTM F1667.

### C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

### D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

### E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

### F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

### G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

## 2.09 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION

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## SECTION 06 20 13

### EXTERIOR FINISH CARPENTRY

#### 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. Exterior cellular PVC trim.
- 2. Exterior cellular PVC sheet panel

- B. Related Requirements:

- 1. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.

##### 1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Verification:
  - 1. For cellular PVC trim & Sheet Panel, with half of exposed surface finished; 50 sq. in..

## 1.05 INFORMATIONAL SUBMITTALS

### A. Evaluation Reports: For the following, from ICC-ES:

1. Cellular PVC trim.
2. Cellular PVC sheet panel.

### B. Sample Warranties: For manufacturer's warranties.

## 1.06 QUALITY ASSURANCE

## 1.07 DELIVERY, STORAGE, AND HANDLING

### A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

## 1.08 FIELD CONDITIONS

### A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

### B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

## 2.01 EXTERIOR TRIM

### A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized rigid material.

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. AZEK Building Products, Inc.
  - b. Kleer Lumber, LLC.
  - c. Versatex Trimboard; a Wolfpac Technologies, Inc. company.

2. Density: Not less than 31 lb/cu. ft..
3. Heat Deflection Temperature: Not less than 130 deg F, according to ASTM D648.
4. Coefficient of Thermal Expansion: Not more than  $4.5 \times 10^{-5}$  inches/inch x deg F.
5. Water Absorption: Not more than 1 percent, according to ASTM D570.
6. Flame-Spread Index: 75 or less, according to ASTM E84.
7. Thickness: 1x nominal (3/4" actual)
8. Texture: Smooth

## 2.02 EXTERIOR PVC SHEET PANELS

- A. Cellular PVC Sheet Panel: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized rigid material.

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. AZEK Building Products, Inc.
  - b. Royal Building Products
  - c. Veranda
2. Density: Not less than 31 lb/cu. ft..
3. Heat Deflection Temperature: Not less than 130 deg F, according to ASTM D648.
4. Coefficient of Thermal Expansion: Not more than  $4.5 \times 10^{-5}$  inches/inch x deg F.
5. Water Absorption: Not more than 1 percent, according to ASTM D570.
6. Flame-Spread Index: 75 or less, according to ASTM E84.
7. Thickness: 1/2"
8. Texture: Smooth

## 2.03 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry (PVC Trim & Sheet Panel): Provide concealed fasteners in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
1. Provide coated, concealed fastener self-tapping screws with plugs to match selected PVC manufacturer PVC board color and texture.  
Basis of Design to be "*Cortex Hidden Fastening Systems for PVC Trim*"  
Tel: 1-800-518-3569, Web: <https://www.fastenmaster.com/products/cortex-loose-plug-for-pvc-trim-board>
- B. Adhesive for Cellular PVC Trim & Sheet Panels: Product recommended by trim manufacturer.
- C. Flashing: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
1. Horizontal Joint Flashing for Panel Siding: Preformed stainless steel, Z-shaped flashing.

- D. Sealants: Latex, complying with ASTM C834 Type OP, Grade NF and applicable requirements in Section 07 92 00 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.
  - 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. Pecora Corporation.
    - b. Permthane®/Acryl-R®; ITW Polymers Sealants North America.
    - c. Tremco, Inc.

## 2.04 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
  - 1. Cut to required lengths and prime ends.
  - 2. Comply with requirements in Section 09 90 00 "Painting."

### 3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.

- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
  - 1. Use concealed shims where necessary for alignment.
  - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
  - 3. Refinish and seal cuts as recommended by manufacturer.
  - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
  - 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

### 3.04 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install cellular PVC trim to comply with manufacturer's written instructions.
- B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
  - 1. Use scarf joints for end-to-end joints.
  - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water.
  - 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
  - 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

### 3.05 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
  - 1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

### 3.06 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.



### 3.07 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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## SECTION 06 20 23

### INTERIOR FINISH CARPENTRY

#### 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. Fire Retardant Treated Interior plywood paneling.
2. Glass Transaction & Pass-Thru Window and accessories.
3. Reclaimed Wood Paneling

###### B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Section 09 90 00 "Painting" for priming and backpriming of interior finish carpentry.

##### 1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
  1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
  2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For foam-plastic moldings, with half of exposed surface finished; 50 sq. in..
3. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
  2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.

## 2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
  1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
  2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
  4. Do not use material that is warped or does not comply with requirements for untreated material.
  5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
    - a. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency].
  6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
    - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
  7. Application: All interior lumber and plywood

## 2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.[For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
  2. Framing for non-load-bearing partitions.
  3. Roof construction.
  4. Plywood backing panels.

#### 2.04 GLASS TRANSACTION COUNTER / FRAMELESS GLASS PASS-THRU WINDOW

- A. See drawings regarding location for pass-thru window.
- B. Pass-thru window is to be a complete assembly by one manufacturer and be coordinated with millwork and counter assembly.
- C. Product is based on CRL Aluminum, Sharyn Model Frameless Glass Pass-Thru Window for ¼" tempered glass.
- 1) Model: SH48x48XX\_
  - 2) Kit includes the following
    - a) One (1) Overhead Track
    - b) Four (4) Roller Accessories
    - c) One (1) Inner Guide
    - d) Two (2) Outer Guides
    - e) One (1) LK50 Lock, Keyed lock with mounting plate (has keys for locking capabilities)
    - f) Two (2) Door Pull / Strike
    - g) Eight (8) Bumpers

h) Two (2) Glass Panels (1/4" Tempered Glazing)

2.05 RECLAIMED WOOD PANELING

- A. Custom milled wood paneling fabricated from reclaimed softwoods wire-brushed abraded with brushing heads that remove loose debris, weathered and aged surfaces to expose the grain of the wood and preserves the original surface of the boards, resulting in a rustic surface that exposes original saw marks and character imperfections.
1. Acceptable products include the following or approved equal:
    - a. Longleaf Lumber, Cambridge, MA, product: "Wire Brushed Softwoods Paneling".
    - b. Bingham Lumber, Brookline NH, product: Barn Siding and Paneling
    - c. Jarmak Corporation, Oxford, MA, product: "Reclaimed Wall Paneling".
    - d. StoriedBoards, Lake George, NY, product: "Barn Board".
  2. Panel characteristics:
    - a. Thickness: 1 inch.
    - b. Edge detail: Tongue and groove or routed to receive concealed fasteners.
    - c. Finish: Mill finish as described herein.
    - d. Minimum board width: 6 inches.
  3. Panel fastening system: Extruded aluminum "Z" clip panel fasteners. Acceptable products include the following or approved equal:
    - a. Scottvale Metal Products, Inc., Bohemia, NY.
    - b. Monarch Metal Fabrication, Inc., Bohemia, NY.
    - c. Brooklyn Hardware, Portland OR.
  4. Fabrication Paneling:
    - a. Fabrication panels as detailed and at outside and inside corners with prominent grain facing in direction approved by the Engineer. Fabricate to required sizes within the following tolerances.
      - 1) Thickness: Plus or minus 1/16 inch.
      - 2) Size (dimension each side): Plus or minus 1/16 inch.
      - 3) Squareness (difference in length of two diagonal measurements): Plus or minus 1/16 inch.

2.06 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

- B. Low-Emitting Materials: Adhesives shall 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."
- C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- D. Installation Adhesive for Foam-Plastic Moldings: Product recommended for indicated use by foam-plastic molding manufacturer.
- E. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.
- F. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

## 2.07 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
  - 1. Interior standing and running trim, except shoe and crown molds.
  - 2. Wood-board paneling.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

### 3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
  - 1. Use concealed shims where necessary for alignment.
  - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.04 FIRE RETARDANT TREATED PANELING INSTALLATION

- A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.
  - 1. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings.
  - 2. Install with uniform tight joints between panels.
  - 3. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
  - 4. Space fasteners and adhesive as recommended by panel manufacturer.
  - 5. Conceal fasteners to greatest practical extent.
  - 6. Arrange panels with grooves and joints over supports.
    - a. Fasten to supports with nails of type and at spacing recommended by panel manufacturer.
    - b. Use fasteners with prefinished heads matching groove color.

### 3.05 INSTALLATION – RECLAIMED WOOD PANELING

- A. Install panels as detailed at outside and inside corners with prominent grain in direction approved by Engineer. Secure paneling to supporting substrate with specified concealed panel fastening system, by blind nailing on back-up furring strips, and with similar associated trim and framing. Install panels within the following tolerances:
  - 1. Typical joint width: None.
  - 2. Full height panels shall have 3 rows of continuous panel fasteners.
  - 3. Maximum offset in alignment at corners: 1/16 inch.
  - 4. Step between faces of adjacent panels 1/16 inch.
  - 5. Plumbness overall of installed panel system: Plus or minus 1/8 inch in 10 feet.



- B. Face nailing will not be permitted.

### 3.06 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
  - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

### CLEANING

- A. Clean interior finish carpentry on exposed and semi-exposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

### PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### END OF SECTION

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## SECTION 06 40 23

### INTERIOR ARCHITECTURAL WOODWORK

#### 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. Interior standing and running trim.
2. Closet and utility shelving.
3. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
4. Shop finishing and construction of interior architectural woodwork.

###### B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 06 20 23 "Interior Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

##### 1.03 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

##### 1.04 PREINSTALLATION MEETINGS

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

##### 1.05 ACTION SUBMITTALS

###### A. Product Data: For the following:

1. Anchors.
2. Adhesives.

3. Shop finishing materials.
  4. Wood-Preservative Treatment:
    - a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
    - b. Indicate type of preservative used and net amount of preservative retained.
    - c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.
  5. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
  6. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Shop Drawings:
1. Include the following:
    - a. Dimensioned plans, elevations, and sections.
    - b. Attachment details.
  2. Show full-size details.
  3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
  4. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each shop-applied color and finish specified.
1. Size:
    - a. Panel Products: 12 inches by 12 inches.
    - b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
- D. Samples for Initial Selection: For each type of shop-applied exposed finish.
1. Size:
    - a. Panel Products: 12 inches by 12 inches.
    - b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
- E. Samples for Verification: For the following:
1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
  2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.

3. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.
  - a. Finish one-half of exposed surface.

#### 1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For architectural woodwork manufacturer and Installer.
- B. Product Certificates: For the following:
  1. Composite wood and agrifiber products.
  2. Adhesives.
- C. Evaluation Reports: For [preservative-treated and fire-retardant-treated wood materials, from ICC-ES.
- D. Field quality-control reports.

#### 1.07 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.08 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
  2. Installer Qualifications: Manufacturer of products and Licensed participant in AWI's Quality Certification Program.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  1. Build mockups of typical interior architectural woodwork as shown on Drawings.
  2. 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.
  3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.

- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
  - 1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

#### 1.010 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.011 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

### PART 2 - PRODUCTS

#### 2.01 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

## 2.02 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

### A. Architectural Woodwork Standards Grade: Custom

#### B. Hardwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Species: Red oak
3. Cut: Plain sliced/plain sawn
4. Wood Moisture Content: 8 to 13 percent.
5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
6. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
  - a. For veneered base, use hardwood lumber core, glued for width.
7. For base wider than available lumber, glue for width. Do not use veneered construction.
8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

#### C. Softwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Species: Eastern white pine
3. Cut: Plain sawn
4. Wood Moisture Content: 8 to 13 percent.
5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
6. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
  - a. For veneered base, use softwood lumber core, glued for width.
7. For base wider than available lumber, glue for width. Do not use veneered construction.
8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
9. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

## 2.03 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

### A. Architectural Woodwork Standards Grade: Custom

1. Wood Species: Any closed-grain hardwood
2. Wood Moisture Content: 8 to 13 percent.

## 2.04 CLOSET AND UTILITY SHELVING

### A. Architectural Woodwork Standards Grade: Custom

### B. Shelf Material: 3/4-inch solid lumber

### C. Cleats: 3/4-inch solid lumber

### D. Wood Species: Match species indicated for door to closet where shelving is located

### E. Closet Rods: 1-5/16-inch- diameter, Aluminum tubes complying with BHMA A156.16, L03131.

### F. Rod Flanges: Aluminum

### G. Wood Finish: Opaque

## 2.05 HARDWOOD SHEET MATERIALS

### A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130
2. Softwood Plywood: DOC PS 1, medium-density overlay
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

## 2.06 PRESERVATIVE-TREATED-WOOD MATERIALS

### A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

### B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry

## 2.07 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
  - 1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWP A U1; Use Category UC3b.
    - a. Provide where in contact with concrete or masonry
    - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
    - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium
    - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
  - 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
  - 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

## 2.08 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
  - 1. Ease edges to radius indicated for the following:
    - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
    - b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
  - 1. Disassemble components only as necessary for shipment and installation.
  - 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
  - 3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
  - 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
    - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.



- b. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

## 2.09 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 91 00 "Painting."
  - 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.
- C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 09 91 00 "Painting."
  - 1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

## 2.010 SHOP FINISHING

- A. Finish interior architectural woodwork indicated on Drawings at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
  - 1. Architectural Woodwork Standards Grade: Same as item to be finished.
  - 2. Finish: System - 4, Latex Acrylic, Water Based unless specified or indicated elsewhere.
  - 3. Staining: As selected by Architect from manufacturer's full range
  - 4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
  - 5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
  - 6. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter according to ASTM D523.
- D. Opaque Finish:

1. Architectural Woodworking Standards Grade: Same as item to be finished.
2. Finish: System - 4, Latex Acrylic, Water Based, unless specified or indicated elsewhere.
3. Color: As selected by Architect from manufacturer's full range
4. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter according to ASTM D523.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

### 3.02 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
  1. Shim as required with concealed shims.
  2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPAC M4.
- F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
  1. Secure with countersunk, concealed fasteners and blind nailing.
  2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
  3. For shop-finished items, use filler matching finish of items being installed.
- H. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 96-inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

### 3.03 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

### 3.04 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
  1. Fill nail holes with matching filler where exposed.
  2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See Section 09 91 00 "Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

### 3.05 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION

SECTION 06 64 00  
PLASTIC PANELING

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. Plastic sheet paneling.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.04 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight 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

2.01 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

## 2.02 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
  - 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. Crane Composites, Inc.
    - b. Marlite.
    - c. Nudo Products, Inc.
  - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 3. Nominal Thickness: Not less than 0.075 inch
  - 4. Surface Finish: Smooth
  - 5. Color: As selected by Architect from manufacturer's full range.

## 2.03 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners and caps as needed to conceal edges.
  - 1. Color: As selected by Architect from manufacturer's full range.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
- E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
  - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
  - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

### 3.03 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
  - 1. Drill oversized fastener holes in panels and center fasteners in holes.
  - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive and fasteners. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 00 01  
WATERPROOFING, DAMPPROOFING AND CAULKING  
FILED SUB-BID REQUIREMENTS

**PART 1 - GENERAL**

**1.01 GENERAL PROVISIONS**

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 0 – Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the filed sub-bid “Waterproofing, dampproofing, and caulking” include all of the following listed Specification Sections: in their entirety:
- 1. Section 07 00 01 – WATERPROOFING, DAMPPROOFING, AND CAULKING  
FILED SUB-BID REQUIREMENTS**
  - 2. Section 07 11 13 – BITUMINOUS DAMPPROOFING**
  - 3. Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS**
  - 4. Section 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIERS**
  - 5. Section 07 92 00 – JOINT SEALANTS**
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

***New Department of Public Works Facility:***

**General:** G000, G001, G101, G102, G201, G202, G301

**Civil:** C001, C200, C201, C202, C300, C301, C302, C401

**Structural:** S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S121, S130, S131, S131B, S131C, S140, S201, S202, S301, S302, S303, S304, S305, S306, S311, S312, S901, S902

**Architectural:** A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A112, A113A, A113B, A113C, A114, A115A, A115B, A115C, A201, A211, A212, A213, A221, A231, A232, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A511, A512, A601, A602, A611, A612, A631, A701, A702, A703, A801, A811, A821, A821, A832, A841, A851, A901, A911, A912, A913

**Industrial Equipment:** EQ101, EQ201, EQ103, EQ104

**Fire Protection:** FP000, FP111A, FP111B, FP111C, FP112A, FP112B, FP112C, FP 501, FP502

**Plumbing:** P000, P101A, P101B, P101C, P111A, P111B, P111C, P121A, P121B, P401, P402, P403, P404, P501, P502, P503, P504

**HVAC:** H001, H101A, H101B, H101C, H102A, H102B, H102C, H200C, H201A, H201B, H201C, H202A, H202B, H202C, H401, H501, H502, H503, H504

**Electrical:** E001, E002, E111A, E11B, E111C, E112, E211A, E211B, E211C, E212, E501, E502, E503, E504, E505, FA001, FA111A, FA111B, FA111C, FA112, TC001, TC111A, TC111B, TC111C

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTION TO BIDDERS.
1. The following shall appear on the upper left-hand corner of the envelope:
  2.

|                     |                                            |
|---------------------|--------------------------------------------|
| NAME OF SUB-BIDDER: | _____                                      |
| SUB-BID FOR TRADE:  | WATERPROOFING, DAMPPROOFING, &<br>CAULKING |
  3. Each sub-bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit.
- G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

## 1.02 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.



### 1.03 SEQUENCING

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

## PART 2 - PRODUCTS

### 2.01 SCAFFOLDS AND STAGING

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
  - 1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
  - 2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
  - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
  - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

### 2.02 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

## **PART 3 - EXECUTION**

### **3.01 DAILY CLEANUP**

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

END OF SECTION

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## SECTION 07 11 13

### BITUMINOUS DAMPPROOFING (FILED SUB-BID REQUIRED AS PART OF 07 00 01)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - A. Cold-applied, emulsified-asphalt dampproofing.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course auxiliary materials recommended in writing by manufacturer of primary materials.

## 2.2 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

## 2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- 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. Karnak Corporation “100 Non-Fibred Emulsion Dampproofing”
  - 2. Henry Company “788 Non-Fibred Asphalt Emulsion
  - 3. BASF Corporation Construction Systems “MasterSeal 600 Series
- B. Trowel Coats: ASTM D1227, Type II, Class 1.
- C. Fibred Brush and Spray Coats: ASTM D1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

## 2.4 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.
- E. Protection Course: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
  - A. Thickness: Nominal 1/4 inch
  - B. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer for protection course type.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections

### 3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
  - A. Apply dampproofing to provide continuous plane of protection.
  - B. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
  - A. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
  - B. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.

- A. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
- B. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

### 3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: One fibered brush or spray coat at not less than 3 gal./100 sq. ft.
- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..

### 3.5 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
  - A. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
  - B. Install protection course within 24 hours of dampproofing installation (while coating is tacky) to ensure adhesion.

### 3.6 PROTECTION

- A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

END OF SECTION

## SECTION 07 21 00

### THERMAL INSULATION

#### 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. Extruded polystyrene foam-plastic board insulation.  
*(Underslab rigid insulation and foundation wall insulation)*
2. Mineral-wool blanket insulation.
3. Polyurethane structural thermal breaks.
4. Wall cladding support structural thermal breaks.

###### B. Related Requirements:

1. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 04 20 00 - Unit Masonry.
4. Section 05 40 00 - Cold-Formed Metal Framing.
5. Section 07 21 19 - Foamed-In-Place Insulation.

##### 1.03 ACTION SUBMITTALS

###### A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.  
*(Underslab rigid insulation and foundation wall insulation)*
2. Mineral-wool blanket insulation.

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.
- D. Compliance Submittal: Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

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

### PART 2 - PRODUCTS

#### 2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Standard Compressive Strength - Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
  - 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. DuPont de Nemours, Inc.
    - b. Owens Corning.
    - c. The Dow Chemical Company.
  - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
  - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
  - 5. Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.
- B. High Compressive Strength - Extruded Polystyrene Board Insulation, Type VII: ASTM C578, Type VII, 60-psi minimum compressive strength.



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. DuPont de Nemours, Inc.
  - b. Owens Corning.
  - c. The Dow Chemical Company.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.

## 2.02 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type IA (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
  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. Rockwool International.
    - c. Thermafiber, Inc.; an Owens Corning company.
  2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
  4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

## 2.03 POLYURETHANE STRUCTURAL THERMAL BREAKS

- A. Performance and Design Requirements:
  1. Structural Performance:
    - a. Provide structural thermal break material and connections capable of withstanding and/or transferring shear, moment, and wind design loads.
    - b. Allow for fabrication and construction tolerances, accommodate live load deflection, shrinkage, and creep of the building structure and other building movements as required by building code.
    - c. Maintain structural steel deflections per AISC 360.
  2. Thermal Performance, Column Base Insulation Blocks: Effective R-Value of floor shall meet or exceed design requirements of building code. Calculate or model effective R-Value in accordance with IACSC Energy Modeling Guideline for Cold Storage and Refrigeration Warehouse Facilities, Table 4.1.1-1.
- B. Basis of Design: Armatherm 500-200; as manufactured by Armatherm:
  1. Performance Requirements:

- a. Compressive Strength (ASTM D1621): 1131 psi (7.8 MPa).
  - b. Compressive Modulus (ASTM D1621): 29,000 psi (200 MPa).
  - c. Shear Strength (ASTM C273): 257 psi (1.77 MPa).
  - d. Thermal Conductivity, U-Value (ASTM C518): 0.40.
  - e. Coefficient of Thermal Expansion (ASTM E831):  $25 \times 10^{-6}$  in/in/degree F.
  - f. Thermal Resistance, R-Value (ASTM C518): 2.5.
- 2. Description: High-strength, polyurethane thermal break.
- 3. Thickness: As indicated on Drawings.
  - a. Wall to foundation transition at exterior CMU veneer.
  - b. As indicated on Drawings.
- C. 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. Armatherm.
  - 2. General Plastics (GP).
  - 3. Thermal Bridging Solution.

## 2.04 WALL CLADDING SUPPORT STRUCTURAL THERMAL BREAKS

- A. Performance and Design Requirements:
  - 1. Thermal Design: Wall assembly or interface detail shall meet the ASHRAE 90.1 requirements for continuous insulation:
    - a. Wall assembly shall not have structural connections (beams, support framing, sub girts, clips) which create thermal bridging.
    - b. Effective U values of wall assemblies shall meet or exceed the design requirements per code.
    - c. Effective U value calculation or modeling shall be performed in accordance with ASHRAE guidelines.
    - d. Three-dimensional thermal modeling report should include the impact of the support/attachment system on the effective U value of the wall assembly.
    - e. Wall assembly effective U value shall be as indicated on Drawings.
    - f.
  - 2. Structural Performance: Exterior wall/cladding panel assemblies are required to demonstrate the ability to meet requirements for the following:
    - a. Live loads such as wind and snow loads, dead load.
    - b. Thermal movements.
    - c. Temperature change.
    - d. Design facade attachment support framing using performance requirements and design criteria indicated.
    - e. Provide comprehensive engineering analysis by a qualified professional engineer which includes wall panel manufacturer's analysis of design loads.
- B. Basis of Design: Armatherm Z GIRT; as manufactured by Armatherm.
  - 1. Performance Requirements:
    - a. Compressive Strength (ASTM D638): 40,000 psi (276 MPa).
    - b. Compressive Modulus (ASTM D695): 673,400 psi (4643 MPa).
    - c. Shear Strength (ASTM D732): 16,000 psi (110 MPa).
    - d. Thermal Conductivity, U-Value (ASTM C518): 1.05.
    - e. Coefficient of Thermal Expansion (ASTM E831):  $2.2 \times 10^{-6}$  in/in/degree F.
    - f. Thermal Resistance, R-Value (ASTM C518): 0.95.
    - g. Surface Burning Characteristics (ASTM E84):

- 1) Flame Spread: 25, Class A.
  - 2) Smoke Developed: 50, Class A.
  2. Spacing: As recommended by Manufacturer.
  3. Connectors and Fasteners: Minimum ultimate pull-out capacity from shall be 450 pounds (204 kg).
- C. 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. Armatherm - Z Girts.
  2. Advance Architectural Products (AAP) – GreenGirt.
  3. Cladiator - SLOTTED-Z.

## 2.05 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
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. AGM Industries, Inc.
    - b. Gemco.
  2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
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. Gemco.
  2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
  3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
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. AGM Industries, Inc.
    - b. Gemco.
  - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
  - D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
    - 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. AGM Industries, Inc.
      - b. Gemco.
- 2.06 ACCESSORIES
- A. Insulation for Miscellaneous Voids:
    - 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
  - B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## PART 3 - EXECUTION

### 3.01 PREPARATION

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

### 3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.03 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

### 3.04 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
  - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
  - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
  - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
  - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

### 3.05 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
  - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
  - 2. Press units firmly against inside substrates.
  - 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

### 3.06 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

### 3.07 PROTECTION

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

END OF SECTION

## SECTION 07 21 19

### FOAMED-IN-PLACE INSULATION

#### 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. Closed-cell spray polyurethane foam.
- B. Related Requirements:
  - 1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES

##### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## PART 2 - PRODUCTS

### 2.01 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Icynene-Lapolla; Icynene.
    - c. Johns Manville; a Berkshire Hathaway company.
  - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### 2.02 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

### 3.02 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.



- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings.
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

### 3.03 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

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## SECTION 07 26 00

### VAPOR RETARDERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Underslab Vapor Retarders

##### 1.02 ACTION SUBMITTALS

###### A. Product Data: For each type of product.

##### 1.03 INFORMATIONAL SUBMITTALS

###### A. Product test reports.

#### PART 2 - PRODUCTS

##### 2.01 UNDER SLAB VAPOR BARRIERS:

###### A. Manufacturers and products:

1. Specified Product (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Raven Industries, Sioux Falls, SD, Product: "VaporBlock Plus VBP20".
2. Acceptable manufacturers: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, but are not limited to, the following:
  - a. Raven Industries, Sioux Falls, SD, product "VaporBlock Plus VBP20".
  - b. Stego Industries LLC, San Juan Capistrano, CA, product: "Stego Wrap (20 mil)".
  - c. Poly-America, Grand Prairie, TX, product: "Yellow Guard (20 mil)".

###### B. Vapor barrier: Seven layer co-extruded gas and moisture barrier fabricated from polyethylene and EVOH resins, Class A

###### C. Characteristics:

1. Minimum thickness: 20 mils.

2. Weight: 102 lbs/msf.
3. Permeance (new) when tested in accordance with ASTM E 154 (Sections 7): Less than 0.0098 perms (gr/ft<sup>2</sup>/hr/in-Hg).
4. Permeance (after conditioning) when tested in accordance with ASTM E 154 (Sections 8 and 11): Less than 0.0079 perms (gr/ft<sup>2</sup>/hr/in-Hg).
5. Tensile strength when tested in accordance with ASTM E 154 (Section 9): 58 lbf.
6. Impact resistance when tested in accordance with ASTM D 1709: 2,600 g.
7. Water vapor transmission rate when tested in accordance with ASTM E 96: 0.0040 grains/hr-ft<sup>2</sup>.
8. Radon diffusion coefficient when tested K124/02/95:  $<1.1 \times 10^{-13} \text{m}^2/\text{s}$ .

## 2.02 ACCESSORIES:

- A. General: Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each type of vapor barrier.
- B. Seam Tape: High density polyethylene tape or HDPE tape as recommended by vapor barrier manufacturer, with pressure sensitive adhesive. Minimum width 4 inches.
- C. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF VAPOR RETARDERS UNDER SLAB ON GRADE

- A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
  1. Extend vapor retarder vertically minimum 24 inches above top of footing.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

END OF SECTION

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## SECTION 07 27 13

### MODIFIED BITUMINOUS SHEET AIR BARRIERS (FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 01)

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.
- B. Related Requirements:
  - 1. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete foundation work, walls and slabs.
  - 2. Section 04 20 00 - UNIT MASONRY: Masonry wall coordination for coordination with openings.
  - 3. Section 07 26 00 - VAPOR RETARDERS:
    - a. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.
  - 4. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.

##### 1.02 PREINSTALLATION MEETINGS

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

##### 1.03 ACTION SUBMITTALS

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

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of modified bituminous sheet air barrier.
- B. Product test reports.
- C. Field quality-control reports.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
  - 1. Build integrated mockups of exterior wall assembly , 150 sq. ft. incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E2357.

### 2.02 SELF-ADHERING SHEET AIR BARRIER (VAPOR IMPERMEABLE)

- A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.
    - b. Henry Company.
    - c. Tremco Incorporated.
  - 2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
- b. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.
- c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
- d. Puncture Resistance: Minimum 40 lbf; ASTM E154/E154M.
- e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D570.
- f. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
- g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA.
- h. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- i. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.03 SELF-ADHERING SHEET AIR BARRIER (VAPOR PERMEABLE AS INDICATED IN DEMISING WALLS AS INDICATED ON DRAWINGS)

- A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Carlisle Coatings & Waterproofing Inc.
- b. Henry Company.
- c. Tremco Incorporated.

- 2. Physical and Performance Properties:

- A. Water Vapor Transmission (ASTM E 96, Method B): 202 g/m<sup>2</sup>/ 24 hours, (29 perms).
- B. Water Vapor Permeability: 1658 ng/Pa.m<sup>2</sup> s.
- C. Peel adhesion to unprimed plywood (tested per ICC ES AC48):
  - 1) Control baseline: 62 lbf/ft (905N/m).
  - 2) After 7 day water immersion: 54 lbf/ft (786N/m).
  - 3) After accelerated aging: 72 lbf/ft (1049N/m).
  - 4) After UV exposure: 77 lbf/ft (1125N/m).
- D. Accelerated Aging (tested per ICC ES AC48): 25 cycle test, passed.
- E. Cycling and elongation: (tested per ICC ES AC48): 100 cycle test at minus 20 degrees F., passed.
- F. Criteria for water resistive barriers (tested per ICC ES AC48): passed.
- G. Flame Spread Index (ASTM E 84): 0, Class A.
- H. Smoke Developed (ASTM E 84): 105, Class A.

## 2.04 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

## PART 3 - EXECUTION

### 3.01 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Bridge isolation joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.02 INSTALLATION

- A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
  - 2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
  - 1. Apply sheets in a shingled manner to shed water.
  - 2. Roll sheets firmly to enhance adhesion to substrate.
- D. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
- E. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
- G. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.
- H. Do not cover air barrier until it has been tested and inspected by testing agency.
- I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: As determined by testing agency from among the following tests:
  - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
  - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783.
  - 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- C. Air barriers will be considered defective if they do not pass tests and inspections.
  - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.



- 2. Remove and replace deficient air-barrier components for retesting as specified above.
- D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- E. Prepare test and inspection reports.

### 3.04 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION

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SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 01)

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. Vapor-retarding, fluid-applied air barriers.

- B. Related Requirements:

- 1. Section 04 20 00, "UNIT MASONRY" for coordination cmu cavity wall construction.

1.03 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PREINSTALLATION MEETINGS

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

- 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

## 1.05 ACTION SUBMITTALS

### A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

### B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

## 1.06 INFORMATIONAL SUBMITTALS

### A. Qualification Data: For Installer.

### B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

### C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

### D. Field quality-control reports.

## 1.07 QUALITY ASSURANCE

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

### B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly 150 sq. ft. incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
  - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
  - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

- c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
- 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
  - 1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers
  - 2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E783
  - 3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D4541.
  - 4. Notify Architect seven days in advance of the dates and times when mockups will be tested.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

#### 1.010 FIELD CONDITIONS

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

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E2357.

### 2.03 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

#### 1. Modified Bituminous Type:

- 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) Carlisle Coatings & Waterproofing Inc.
- 2) Henry Company.
- 3) Tremco Incorporated.

#### 2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
- b. Vapor Permeance: Maximum [0.1 perm] ASTM E96/E96M, Desiccant Method.
- c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
- d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

- f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

## 2.04 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
  - 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. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Pecora Corporation.
    - c. The Dow Chemical Company.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
  - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. 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 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.
  - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

#### 3.04 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
  - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils applied in two equal coats.



- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. 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 will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 2. Air-barrier dry film thickness.
  - 3. Continuous structural support of air-barrier system has been provided.
  - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 5. Site conditions for application temperature and dryness of substrates have been maintained.
  - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  - 7. Surfaces have been primed, if applicable.
  - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  - 9. Termination mastic has been applied on cut edges.
  - 10. Strips and transition strips have been firmly adhered to substrate.
  - 11. Compatible materials have been used.
  - 12. Transitions at changes in direction and structural support at gaps have been provided.
  - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  - 14. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
  - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
  - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783
  - 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
  - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.

2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

### 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.
  1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
  2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 27 26

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## SECTION 07 42 93

### SOFFIT PANELS

#### 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. Metal soffit panels.

##### 1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical roof eave , including fascia, and soffit as shown on Drawings; approximately 150 sq ft as coordinated with other trades for mock-up, by full eave width, including attachments and accessories.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

## 1.09 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.010 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.011 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.

- 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

- 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings
  - 3. Deflection Limits: For wind loads, no greater than 1/180 the span.

- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces

## 2.02 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile Metal Soffit Panels Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ATAS International, Inc.
    - b. CENTRIA.
    - c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
  - 2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.034 inch min.
    - b. Exterior Finish: Two-coat fluoropolymer
    - c. Color: As selected by Architect from manufacturer's full range

## 2.03 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.04 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

## 2.05 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
  1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.



2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
  - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
  1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

### 3.03 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  1. Shim or otherwise plumb substrates receiving metal panels.
  2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  3. Install screw fasteners in predrilled holes.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Install flashing and trim as metal panel work proceeds.
  6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
  1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
  2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
  3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
  4. Stainless Steel Panels: Use stainless steel fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Apply panels and associated items true to line for neat and weathertight enclosure.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
  2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
  3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.04 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On

completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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## SECTION 07 54 19

### POLYVINYL-CHLORIDE (PVC) ROOFING (FILED SUB-BID REQUIRED AS PART OF 07 00 02)

#### 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. Adhered polyvinyl chloride (PVC) roofing system.
  - 2. Vapor retarder.
  - 3. Roof insulation.
  - 4. Cover board.

- B. Related Requirements:

- 1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
  - 2. Section 07 71 00 "Roof Specialties" for premanufactured copings and roof edge flashings.
  - 3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

##### 1.03 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

- 1. Layout and thickness of insulation.
  - 2. Base flashings and membrane terminations.

3. Flashing details at penetrations.
4. Tapered insulation thickness and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

C. Samples for Verification: For the following products:

1. Roof membrane and flashing, of color required.
2. Aggregate surfacing material in gradation and color required.
3. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - a. Submit evidence of compliance with performance requirements.
2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

H. Compliance Submittal: Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

#### 1.09 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

#### 1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards and other components of roofing system.
  2. Warranty Period: 30 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
  2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474; and associated building code wind speeds as indicated on the drawings:
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: Class 1A-90 Class 1A-105.
- E. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low slope roof products.
- F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

- G. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- H. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

## 2.02 POLYVINYL CHLORIDE (PVC) ROOFING

- A. PVC Sheet: ASTM D4434/D4434M, Type II, glass-fiber reinforced, felt backed.
  - 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. Sika Sarnafil.
    - b. Soprema, Inc.
  - 2. Thickness: 80 mils
  - 3. Exposed Face Color: White
- B. Source Limitations: Obtain components for roofing system from manufacturers approved by roof membrane manufacturer.

## 2.03 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
  - 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
  - 1. Size: Not less than 4-inch diameter.
- E. Bonding Adhesive: Manufacturer's standard, water based.
- F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.



- H. Slip Sheet: ASTM D2178/D2178M, Type IV, glass fiber, asphalt-impregnated felt.
- I. Slip Sheet: Manufacturer's standard, of thickness required for application.
- J. Vented Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- M. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
  - 1. Fasteners: 1-1/2-inch stainless steel fasteners with neoprene washers.
- N. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- O. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

#### 2.04 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

#### 2.05 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, felt or glass-fiber mat facer on both major surfaces.
  - 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. Carlisle SynTec Incorporated.
    - b. Firestone Building Products.
    - c. GAF.
    - d. Johns Manville; a Berkshire Hathaway company.

2. Compressive Strength: 20 psi
  3. Size: 48 by 48 inches or 48 by 96 inches.
  4. Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.
  5. Thickness:
    - a. Minimum, Flat stock R-Value requirement: R-30. Joints
    - b. Joints / thicknesses to be staggered for total thickness.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: Match roof insulation
  2. Minimum Thickness: 1/4 inch.
  3. Use of certain Hydrofluorocarbons in order to stay within the regulations of 310 CMR 7.76 for rigid insulation.
  4. Slope:
    - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
    - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

## 2.06 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
  2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
  3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
- Cover Board: ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch thick.
- E. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.

2. Thickness: 1/4 inch
3. Surface Finish: Factory primed

## 2.07 ASPHALT MATERIALS

- A. Roofing Asphalt: ASTM D312/D312M, Type III or Type IV
- B. Asphalt Primer: ASTM D41/D41M.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  1. Verify that roof openings and penetrations are in place, curbs are set and braced, are securely clamped in place.
  2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
  4. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.
    - a. Test Frequency: One test probe per each 1000 sq. ft. of roof deck, with no fewer than three test probes.
    - b. Submit test reports within 24 hours of performing tests.
  5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
  6. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
  7. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
  8. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
  9. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within 1/8 inch
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
  - 1. Submit test result within 24 hours of performing tests.
    - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

### 3.03 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 13 "Modified Bituminous Sheet Air Barriers."

### 3.04 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.
  - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
  - 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

### 3.05 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

### 3.06 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
  - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 2. At internal roof drains, conform to slope of drain sump.
    - a. Trim cover board so that water flow is unrestricted.
  - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
  - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    - a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
    - b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
    - c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- B. Install slip sheet over cover board and immediately beneath roof membrane.

### 3.07 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

- F. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- G. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- H. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- I. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
  - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

### 3.08 BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
  - 1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

- a. Perform tests before overlying construction is placed.
  - b. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
  - c. Flood each area for 24 hours.
  - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
    - 1) Cost of retesting is Contractor's responsibility.
  - e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
  - D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
  - E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### 3.010 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

### 3.011 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS \_\_\_\_\_ of \_\_\_\_\_, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

- 1. Owner: **<Insert name of Owner>**.
- 2. Address: **<Insert address>**.
- 3. Building Name/Type: **<Insert information>**.
- 4. Address: **<Insert address>**.
- 5. Area of Work: **<Insert information>**.
- 6. Acceptance Date: \_\_\_\_\_.
- 7. Warranty Period: **<Insert time>**.

8. Expiration Date: \_\_\_\_\_.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. lightning;
    - b. peak gust wind speed exceeding **<Insert mph>**;
    - c. fire;
    - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. vapor condensation on bottom of roofing; and
    - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
  4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.



6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

1. Authorized Signature: \_\_\_\_\_.
2. Name: \_\_\_\_\_.
3. Title: \_\_\_\_\_.

END OF SECTION

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## SECTION 07 62 00

### SHEET METAL FLASHING AND TRIM

#### 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. Manufactured reglets with counterflashing.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

###### B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, and blocking.
2. Section 13 42 00 "Pre-Engineered Metal Building" for roof items only the pre-engineered metal building roof and assemblies.

##### 1.03 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

##### 1.04 PREINSTALLATION MEETINGS

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

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

## 1.05 ACTION SUBMITTALS

### A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

### B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches

### C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

### D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

### E. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

## 1.06 INFORMATIONAL SUBMITTALS

### A. Qualification Data: For fabricator.

- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

#### 1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

#### 1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
  - 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Coordinate mock-up with other sections in order to provide the appropriate sheet metal flashing and trim to make a complete assembly for review and confirmation of the mockup.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
  - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
  - 2. Protect stored sheet metal flashing and trim from contact with water.

- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

#### 1.010 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure: As indicated on Drawings
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.02 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  - 1. As-Milled Finish: Standard one-side bright
  - 2. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
  - 3. Color: As selected by Architect from manufacturer's full range
  - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed; with smooth, flat surface.
  - 1. Finish: ASTM A480/A480M, No. 4 (polished directional satin)
    - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
    - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      - 1) Run grain of directional finishes with long dimension of each piece.
      - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation prepainted by coil-coating process to comply with ASTM A755/A755M.
  - 1. Surface: Smooth, flat
  - 2. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

3. Color: As selected by Architect from manufacturer's full range
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

## 2.03 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
  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. Atlas Roofing Corporation - MPS.
    - b. Intertape Polymer Group.
    - c. Kirsch Building Products, LLC.
  2. Source Limitations: Obtain underlayment from single source from single manufacturer.
- C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
  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. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    - b. Henry Company.
    - c. Owens Corning.
    - d. Protecto Wrap Company.
  2. Source Limitations: Obtain underlayment from single source from single manufacturer.
  3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

## 2.04 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Copper, Zinc-Tin Alloy-Coated Copper, Copper-Clad Stainless Steel Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
  - 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
  - 4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
  - 5. Fasteners for Zinc-Coated (Galvanized), Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
  - 6. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
- C. Solder:
  - 1. For Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
  - 2. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
  - 3. For Zinc-Tin Alloy-Coated Copper: ASTM B32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.
  - 4. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.
  - 5. For Zinc: ASTM B32, 40 percent tin and 60 percent lead with low antimony, with maximum lead content of 0.2 percent, as recommended by zinc manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.



- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
  - 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. Fry Reglet Corporation.
    - b. Hohmann & Barnard, Inc.
    - c. Metal-Era, Inc.
  - 2. Source Limitations: Obtain reglets from single source from single manufacturer.
  - 3. Material: Stainless steel, 0.0188 inch thick
  - 4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  - 6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
  - 7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  - 8. Accessories:
    - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
  - 9. Finish: Mill

## 2.05 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
  - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
  - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
  - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
  - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams:
  - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
  - 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- H. Do not use graphite pencils to mark metal surfaces.

## 2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

### A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

#### A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

#### B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF UNDERLAYMENT

#### A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lap joints not less than 2 inches.

#### B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.
2. Lap end joints not less than 12 inches.

#### C. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.

7. Cover underlayment within 14 days.
- D. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
1. Install in shingle fashion to shed water.
  2. Lapp joints not less than 4 inches.

### 3.03 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and/or sealant as occurs.
  3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
  4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
  5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
  6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
  8. Do not field cut sheet metal flashing and trim by torch.
  9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  3. Use lapped expansion joints only where indicated on Drawings.

- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  - 1. Use sealant-filled joints unless otherwise indicated.
    - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    - b. Form joints to completely conceal sealant.
    - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    - d. Adjust setting proportionately for installation at higher ambient temperatures.
      - 1) Do not install sealant-type joints at temperatures below 40 deg F.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
  - 1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
  - 2. Do not solder metallic-coated steel and aluminum sheet.
  - 3. Do not pretin zinc-tin alloy-coated copper.
  - 4. Do not use torches for soldering.
  - 5. Heat surfaces to receive solder, and flow solder into joint.
    - a. Fill joint completely.
    - b. Completely remove flux and spatter from exposed surfaces.
  - 6. Stainless Steel Soldering:
    - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
    - b. Promptly remove acid-flux residue from metal after tinning and soldering.
    - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
  - 7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
  - 8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

### 3.04 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

### 3.05 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
  - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
  - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
  - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
  - 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
  - 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
  - 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
  - 2. Extend counterflashing 4 inches over base flashing.
  - 3. Lap counterflashing joints minimum of 4 inches.
  - 4. Secure in waterproof manner by means of anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas unless otherwise indicated.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

### 3.06 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

- C. Reglets: Installation of reglets is specified in Section 03 30 00 "Cast-in-Place Concrete." And Section 04 20 00 "Unit Masonry."

### 3.07 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
  - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
  - 2. Weld or seal flashing with elastomeric sealant to equipment support member.

### 3.08 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.09 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

### 3.010 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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## SECTION 07 84 43

### JOINT FIRESTOPPING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior wall/wall intersections.
3. Joints in smoke barriers.

###### B. Related Requirements:

1. Division 21- FIRE PROTECTION: Fire Protection System penetrating through fire rated construction.
2. Division 22- PLUMBING: Plumbing System penetrating through fire rated construction.
3. Division 23- HVAC: Heating, ventilating and air conditioning system penetrations through fire rated construction.
4. Division 26 - ELECTRICAL: Electrical system penetrations through fire rated construction.

##### 1.02 PREINSTALLATION MEETINGS

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

##### 1.03 ACTION SUBMITTALS

- ###### A. Product Data: For each type of product.

- ###### B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

##### 1.04 INFORMATIONAL SUBMITTALS

- ###### A. Product test reports.



## 1.05 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
      - 1) UL in its "Fire Resistance Directory."
      - 2) Intertek Group in its "Directory of Listed Building Products."

### 2.02 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Rockwool International.
  - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

- C. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Rockwool International.
  - 2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- E. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
  - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
  - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
  - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.02 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.03 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION

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SECTION 07 92 00  
JOINT SEALANTS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 01)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Mildew-resistant joint sealants.
6. Latex joint sealants.

B. Related Requirements:

1. Section 04 20 00- UNIT MASONRY.
2. Section 07 62 00- SHEET METAL FLASHING AND TRIM: Sealant integral with flashings.
3. Section 07 84 00- FIRESTOPPING: Firestopping sealants and related backing materials.
4. Section 08 17 43 AF COMPOSITE DOORS AND FRAMES: Interior and exterior fiberglass frames to receive perimeter sealant provided by this section.
5. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES: Interior and Exterior sealants of polycarbonate panel assemblies.
6. Section 08 91 19 – FIXED LOUVERS: Interior and exterior of louver perimeters.
7. Section 09 90 00 - PAINTING: Sealants used in preparation of applied finish coatings.

1.02 PREINSTALLATION MEETINGS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports.
- D. Field-adhesion-test reports.
- E. Sample warranties.

#### 1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

#### 1.06 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
  - 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

#### 1.07 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 JOINT SEALANTS, GENERAL

- A. Colors of Exposed Joint Sealant As selected by Architect from manufacturer's full range.

### 2.02 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Pecora Corporation.
    - c. Sika Corporation; Joint Sealants.
- C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. The Dow Chemical Company.
- D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Pecora Corporation.
    - c. The Dow Chemical Company.

- E. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Sika Corporation; Joint Sealants.
    - c. The Dow Chemical Company.
- F. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Soudal USA.
    - b. The Dow Chemical Company.
- G. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. May National Associates, Inc.; a subsidiary of Sika Corporation.
    - b. Pecora Corporation.
    - c. Sika Corporation; Joint Sealants.
- H. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. May National Associates, Inc.; a subsidiary of Sika Corporation.
    - b. Pecora Corporation.
    - c. Sika Corporation; Joint Sealants.
- I. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. May National Associates, Inc.; a subsidiary of Sika Corporation.

- J. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. May National Associates, Inc.; a subsidiary of Sika Corporation.
- b. Sika Corporation; Joint Sealants.

## 2.03 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Pecora Corporation.
- b. Sika Corporation; Joint Sealants.
- c. Tremco Incorporated.

- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Pecora Corporation.
- b. Sika Corporation; Joint Sealants.
- c. The Dow Chemical Company.

- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. The Dow Chemical Company.

- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:



- a. Tremco Incorporated.

## 2.04 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Sika Corporation; Joint Sealants.
    - c. Tremco Incorporated.
- B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Sika Corporation; Joint Sealants.
- C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. LymTal International Inc.
- D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Bostik, Inc.
- E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Pecora Corporation.

- c. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
- F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Pecora Corporation.
- G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Sherwin-Williams Company (The).
- H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Tremco Incorporated.
- I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Pecora Corporation.
    - c. Sika Corporation; Joint Sealants.
- J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. LymTal International Inc.
- K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement

capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. BASF Corporation.
  - b. Pecora Corporation.
  - c. Sika Corporation; Joint Sealants.

## 2.05 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1, tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Tremco Incorporated.

- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. BASF Corporation.

- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Tremco Incorporated.

- E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. BASF Corporation.
- b. Sika Corporation; Joint Sealants.

- F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Pecora Corporation.
    - c. Tremco Incorporated.
- G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Tremco Incorporated.
- H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sika Corporation; Joint Sealants.
    - b. Tremco Incorporated.
    - c. W.R. Meadows, Inc.
- I. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. LymTal International Inc.
    - b. Tremco Incorporated.
- J. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Sika Corporation; Joint Sealants.

- K. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, and I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. BASF Corporation.
- b. LymTal International Inc.
- c. Sika Corporation; Joint Sealants.

## 2.06 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Pecora Corporation.
- b. The Dow Chemical Company.
- c. Tremco Incorporated.

- C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Pecora Corporation.
- b. Sherwin-Williams Company (The).
- c. Tremco Incorporated.

## 2.07 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Alcot Plastics Ltd.
- b. BASF Corporation.
- c. Construction Foam Products; a division of Nomaco, Inc.

- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

## 2.08 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

### 3.02 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

- 1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

### 3.03 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

- 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.04 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces: JS-A.

- 1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Joints between plant-precast architectural concrete paving units.
    - c. Tile control and expansion joints.
    - d. Joints between different materials listed above.
    - e. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, M, P, 50, T, NT
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion: JS-B

- 1. Joint Locations:
    - a. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces: JS- C
1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Joints between plant-precast architectural concrete units.
    - c. Control and expansion joints in unit masonry.
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces: JS-D
1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, S, P, 25, T, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces: JS-E.
1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of unit masonry, concrete walls and partitions.
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement: JS-F.
1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Acrylic latex.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors



G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces: JS-G.

1. Joint Locations:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

H. Joint-Sealant Application: Concealed mastics: JS-H.

1. Joint Locations:

- a. Aluminum thresholds.
- b. Sill plates.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

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SECTION 08 11 00  
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. Interior standard steel doors and frames.

- B. Related Requirements:

- 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.04 COORDINATION

- A. Coordinate anchorage installation 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. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.05 PREINSTALLATION MEETINGS

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

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Concept Frames, Inc.
3. DE LA FONTAINE.
4. Steelcraft; an Allegion brand.

2.02 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

## 2.03 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
  - 1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
    - d. Edge Construction: Model 1, Full Flush
    - e. Edge Bevel: Provide manufacturer's standard beveled or square edges
    - f. Core: Polystyrene
  - 2. Frames:
    - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    - b. Construction: Full profile welded
  - 3. Exposed Finish: Prime

## 2.04 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
  - 1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
    - d. Edge Construction: Model 1, Full Flush
    - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
    - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
    - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
    - h. Core: Polystyrene

2. Frames:
  - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
  - b. Construction: Full profile welded
  - c. Thermally broken frames.
3. Exposed Finish: Prime

## 2.05 FRAME ANCHORS

- A. Jamb Anchors:
  1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

## 2.06 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

## 2.07 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

## 2.08 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.01 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.02 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  - 2. Floor Anchors: Secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Solidly pack mineral-fiber insulation inside frames.
  - 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8

### 3.03 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

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SECTION 08 14 16  
FLUSH WOOD DOORS

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. Flush wood veneer-faced door for transparent finish.

- B. Related Requirements:

- 1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

- 1. Door core materials and construction.
  - 2. Door edge construction
  - 3. Door face type and characteristics.
  - 4. Door louvers.
  - 5. Door trim for openings.
  - 6. Factory-machining criteria.
  - 7. Factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

- 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
  - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
  - 3. Details of frame for each frame type, including dimensions and profile.
  - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.
10. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

## 1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
- B. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

## 1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of veneer.
    - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

### 2.02 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
  - 1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
    - a. Contractor shall register the Work under this Section with the AWI Quality Certification Program at [www.awiqcp.org](http://www.awiqcp.org) or by calling 855-345-0991.
  - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.03 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

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. Lambton Doors.
  - b. Masonite Architectural.
  - c. VT Industries, Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty
3. Faces: Single-ply wood veneer not less than 1/50 inch thick.
  - a. Species: Select white ash, Select white birch. Select white maple, Red oak, White oak, Walnut. Own most expensive option for bidding purposes.
  - b. Cut: Plain sliced (flat sliced)
  - c. Match between Veneer Leaves: Book match.
  - d. Assembly of Veneer Leaves on Door Faces: Running match.
  - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  - f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
4. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A
  - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
  - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
  - c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
    - 1) Finish steel edges and astragals with baked enamel, color from full range of colors for Architect / Owner selection.
    - 2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
  - d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    - 1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.
5. Core for Non-Fire-Rated Doors:

- a. ANSI A208.1, Grade LD-2 particleboard.
    - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
    - 2) Provide doors with glued-wood-stave cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
  - b. Glued wood stave.
  - c. WDMA I.S. 10 structural composite lumber.
    - 1) Screw Withdrawal, Door Face: 550 lbf
    - 2) Screw Withdrawal, Vertical Door Edge: 550 lbf
  - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
6. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.04 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  - 1. Wood Species: Same species as door faces.
  - 2. Profile: Recessed tapered beads.
- B. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
  - 1. Wood Species: Same species as door faces.
  - 2. Profile: Flat.

## 2.05 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
  - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

- 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## 2.06 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 2. Finish faces, all four edges, edges of cutouts, and mortises.
  - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  - 1. Grade: Premium
  - 2. Finish: Architectural Woodwork Standards System-11, Polyurethane, Catalyzed.
  - 3. Staining: As selected by Architect from manufacturer's full range
  - 4. Effect: Open-grain finish
  - 5. Sheen: Satin

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
  - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
  - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
  - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
  - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
  - d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
  1. Provide inspection of installed Work through AWI's Quality Certification Program certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WT's "Architectural Woodwork Standards" for the specified grade.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.04 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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## SECTION 08 17 43

### AF COMPOSITE DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES:

- A. AF Composite flush doors with FRP frames.

##### 1.02 RELATED SECTIONS:

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing

##### 1.03 REFERENCES:

- A. AAMA 920-11 – Specification for Operating Cycle Performance of Side-Hinged Exterior Door Systems.
- B. AAMA 1304-02 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.
- C. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of Hot Box Apparatus.
- D. ASTM D 256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- E. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics.
- F. ASTM D 570 – Standard Test Method for Water Absorption of Plastics.
- G. ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- H. ASTM D 1761-06 – Standard Test Methods for Mechanical Fasteners in Wood.
- I. ASTM D 2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- J. ASTM D 3029 – Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.
- K. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
- L. ASTM E 84-11 – Standard Method of Test for Surface Burning Characteristics of Building Materials.

- M. ASTM E 283-04 – Test Method for Determining Rate of Airflow Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
- N. ASTM E 330-02 – Test Method for Structural Performance of Exterior Windows, Curtain Walls, Doors by Uniform Static Air Pressure Difference.
- O. ASTM E 331-00 – Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- P. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile and Exposed to Cyclic Pressure Differentials.
- Q. ASTM E 1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

#### 1.04 PERFORMANCE REQUIREMENTS:

- A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
- B. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.45 cfm/ft<sup>2</sup>.
- C. Water Penetration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331. Door shall not have water leakage.
- D. Uniform Load Structural: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 330: Plus or minus 80 psf.
- E. Forced Entry Resistance per AAMA 1304-02: Pass
- F. Large Missile Impact Test per ASTM E 1996: Pass
- G. Air Pressure Cycle Test per ASTM E 1886: Plus or Minus 75psf.
- H. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification
- I. Thermal Transmission, Exterior Doors, U-Value, ASTM C 1363: Maximum of 0.18 BTU/hr x sf x degrees F.
- J. Screw Pullout, ASTM D 1761-06, Minimum 924 pounds.
- K. Cycle Test, AAMA 920-11, 2,000,000 Cycles.
- L. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
  - 1. Flame Spread: Maximum of 200, Class C.
  - 2. Smoke Developed: Maximum of 450, Class C.
- M. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both

Faces of FRP Interior Panels, ASTM E 84:

1. Flame Spread: Maximum of 25.
2. Smoke Developed: Maximum of 450.

N. FRP Smooth Face Sheet Properties:

- a. Izod Impact Strength, ASTM D 256, Minimum 7 ft-lb/in notched.
- b. Tensile Strength, ASTM D 638, Minimum  $18 \times 10^3$  psi.
- c. Tensile Modulus, ASTM D 638, Minimum  $18 \times 10^6$  psi.
- d. Water Absorption, ASTM D 570, Maximum 0.16% / 24 hours @ 77°F.
- e. Flexural Strength, ASTM D 790, Minimum  $27 \times 10^3$  psi.
- f. Flexural Modulus, ASTM D 790, Minimum  $.7 \times 10^6$  psi.
- g. Barcol Hardness, ASTM D 2583, Minimum 40.
- h. Gardner Impact Strength, ASTM D 3029, Minimum 30 in-lb.

#### 1.05 SUBMITTALS:

- A. Comply with Section 01 33 23 - Submittals.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, and finish.
- D. Samples:
  1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
  2. Color: Submit manufacturer's samples of standard colors of doors and frames.
- E. Test Reports: Submit test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.
- G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.
- H. Warranty: Submit manufacturer's standard warranty.

#### 1.06 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications:
  1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
  2. Door and frame components from same manufacturer.
  3. Evidence of a compliant documented quality management system.

#### 1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark 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.

1.08 WARRANTY:

- A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Warranty Period: Ten years starting on date of substantial completion. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure due to corrosion

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with basis of design product by, (Special-Lite, Inc.), available manufacturers offering similar products that may be incorporated into the work, include the following, or approved equal:

- A. Special-Lite, Inc. 860 South Williams Street, Decatur MI 49045. Phone (800) 821-6531 Fax (269) 423-6581 Web Site [www.Special-lite.com](http://www.Special-lite.com) E-Mail [info@special-lite.com](mailto:info@special-lite.com)
- B. Chem-Pruf, Brownsville TX
- C. Dorteck, Conshohocken, PA

2.02 FRP FLUSH DOORS:

- A. Model: AF-100 Smooth Pultruded Fiberglass Door
- B. Door Opening Size: As indicated on the Drawings.
- C. Construction:
  - 1. Door Thickness: 1-3/4-inches.
  - 2. Construction: Doors shall be fabricated using insulated pultruded stiles and rails with .120" FRP face sheets. Stiles and rails to be secured at corners with pultruded corner clip.
  - 3. Reinforcement: Solid high-density urethane shapes to be chemically welded at factory.
  - 5. Top Rail: Pultruded FRP insulated stile material.
  - 6. Bottom Rail: Pultruded FRP insulated stile material.
- C. Face Sheet:
  - a. AF-100
    - 1. Material: Exterior Grade UV resistant FRP, 0.120-inch thickness, finish color throughout.
    - 2. Texture: Smooth
    - 3. Color: To be selected from full range of colors. Provide actual color chips for Owner to select from.
- F. Core:

1. Material: Urethane foam

G. Hardware:

1. Pre-machine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

2.03 MATERIALS:

- A. Components: Door and frame components from same manufacturer.
- B. Fasteners:
  1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
  2. Compatibility: Compatible with items to be fastened.

2.04 FABRICATION:

- A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.
- B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
- C. Assembly:
  1. Complete cutting, fitting, forming, drilling, and chemically welding of FRP before assembly.
- D. Fit:
  1. Maintain continuity of line and accurate relation of planes and angles.
  2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.05 ARCHITECTURAL PANELS:

- A. FRP Panels:
  1. Size: As indicated on the Drawings.
  2. Thickness: 1 3/4-inch.
- B. Face Sheets:
  1. Material: FRP, 0.120-inch thickness.
  2. Texture: Smooth
  3. Color: Choose from Manufacturer standard colors. Provide sample for Owner to select from.
- C. Insulated FRP Panels:
  1. Insulated Panels: Two 0.120-inch minimum thickness sheets.
  2. Core: Urethane
  3. Form components to function as single unit.

2.06 FRP FRAMING SYSTEMS:

- A. Framing: AF-150
  1. Size and Type: As indicated on the Drawings.
  2. Materials: 1/4" thick solid pultruded FRP profiles having no corrosive components or reinforcement.
  3. Width: 2" face.

4. Depth: 8 3/4" or as indicated on drawings.
5. Assembly: One-piece, chemically welded at the factory
6. Door Stop: 5/8" x 2 1/4".
7. Corner Construction: Mitered with 2" x 2" x 3/8" pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.
8. Reinforcing: 1/4" pultruded FRP chemically welded at all hinge, strike and closer locations.
9. Anchors: Furnished with type as specified on drawings.
10. Fasteners for reinforcing: 18-8 Stainless Steel.

#### 2.07 HARDWARE:

- A. Pre-machine doors in accordance with templates from specified hardware manufacturers and hardware schedule. Reinforce for specific hardware locations.
- B. Hardware Schedule: As specified in Section 08 71 00 and indicated on drawings.

#### 2.08 FINISH:

- A. Finish For Door Edges and Frames: Primer with a finished color coat.
  1. Painted Finish: Two-part aliphatic polyurethane, low VOC, Industrial Coating.
  2. Thickness: 5 mils
  3. Sheen: Gloss
  4. Impact Resistance per ASTM D 2794: 140 in lbs.
- B. Finish for Face Sheet: Finish color throughout

### PART 3 - EXECUTION

#### 3.01 EXAMINATION:

- A. Examine areas to receive doors. 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 frames are plumb, level, square, and in tolerance.

#### 3.03 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
  1. Install doors plumb, level, square, true to line, and without warp or rack.
  2. Anchor frames securely in place.
  3. Set thresholds in bed of mastic and backseal.
- B. Install exterior doors to be weathertight in closed position.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by

Architect.

- D. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.04 FIELD QUALITY CONTROL:

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.05 ADJUSTING:

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.06 CLEANING:

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.07 PROTECTION:

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

## SECTION 08 31 13

### ACCESS DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. Related Requirements:
  - 1. Section 04 20 00 - UNIT MASONRY: Installation of access panels into masonry assemblies.
  - 2. Section 09 29 00 - GYPSUM BOARD: Installation of access panels in gypsum wall board assemblies.
  - 3. Division 21 - FIRE PROTECTION
  - 4. Division 22 - PLUMBING
  - 5. Division 23 - HVAC
  - 6. Division 26 - ELECTRICAL

##### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames.

##### 1.03 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

##### 1.04 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

#### PART 2 - PRODUCTS

##### 2.01 PERFORMANCE REQUIREMENTS



- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[ and temperature-rise limit] ratings indicated, according to NFPA 252 or UL 10B.

## 2.02 ACCESS DOORS AND FRAMES

### A. Flush Access Doors with Concealed Flanges:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - c. Larsens Manufacturing Company.
- 2. Description: Face of door flush with frame; with concealed flange for installation and concealed hinge.
- 3. Locations: Wall and ceiling
- 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory finished.
- 5. Frame Material: Same material and thickness as door
- 6. Latch and Lock: Cam latch, screwdriver operated

### B. Fire-Rated, Flush Access Doors with Concealed Flanges:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - c. Maxam Metal Products Limited.
- 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for installation, self-closing door, and concealed hinge.
- 3. Locations: Wall and ceiling
- 4. Fire-Resistance Rating: Not less than that of adjacent construction indicated on drawings.
- 5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
- 6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
- 7. Frame Material: Same material, thickness, and finish as door
- 8. Latch and Lock: Self-closing, self-latching door hardware, Cam latch, screwdriver operated.

## 2.03 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

#### 2.04 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

#### 2.05 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

#### 3.02 FIELD QUALITY CONTROL

- A. Inspections:
  - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

- D. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

END OF SECTION

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SECTION 08 36 13  
SECTIONAL DOORS

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 electrically operated sectional doors.
- B. Section includes electrically operated sectional polycarbonate doors. (*Wash Bay*)
- C. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.03 ACTION SUBMITTALS

- A. Submittals not specific to this project, opening, not shown clearly regarding coordination of other building systems, cranes, MEP/FP equipment ***will be rejected.***
- B. Product Data: For each type and size of sectional door and accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
  - 1. Include plans, elevations, sections, and mounting details. Shop drawings must be 1/4" scale and specific to project.
  - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
  - 4. Include diagrams for power, signal, and control wiring.
- D. Samples for Initial Selection: For units with factory-applied finishes.
  - 1. Include Samples of accessories involving color selection.

- E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
  - 1. Flat door sections with sensor edge on bottom section.
  - 2. Frame for paneled door sections; of each width of stile and rail required.
  - 3. Panel for raised-panel door sections; not smaller than required to show raised-panel profile.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

#### 1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Failure of components or operators before reaching required number of operation cycles.
    - c. Faulty operation of hardware.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
    - e. Delamination of exterior or interior facing materials.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
  - 1. Obtain operators and controls from sectional door manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
  - 1. Design Wind Load: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with State Building Code as measure in accordance with ASTM E 330.
  - 2. Testing: According to ASTM E330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
  - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
    - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
    - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
  - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- C. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Component Importance Factor: 1.50.

### 2.03 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Overhead Door Corporation.
    - b. Raynor Garage Doors.
    - c. Wayne Dalton; a division of Overhead Door Corporation.

- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283
- D. Installed R-Value: 17.4 deg F x h x sq. ft./Btu.
- E. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.
  - 1. Section Thickness: 2 inches
  - 2. Exterior-Face, Steel Sheet Thickness: 20 GA nominal coated thickness.
    - a. Surface: Flat.
    - b. Surface: Manufacturer's standard. Flush.
  - 3. Insulation: CFC Free Polyurethane, fully encapsulated.
  - 4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of 20 gauge material
  - 5. Interior Facing Material: 1/8-inch- thick, manufacturer's standard material
- F. Translucent Sections: Manufacturer's standard.
- G. Track Configuration: High-lift track for all places except for low-headroom track options for under mezzanines and existing building / vehicle wash bay. Refer to drawings for specific conditions.
- H. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- I. Windows: Approximately 24-inches tall x evenly spaced widths in even spaces with square corners, and spaced apart the approximate distance as indicated on Drawings; in row(s) at height indicated on Drawings; installed with glazing of the following type:
  - 1. Clear Float Glass: 3 mm thick and complying with ASTM C1036, Type I, Class 1, Quality Q3.
- J. Roller-Tire Material: Case-hardened steel
- K. Locking Devices: Equip door with slide bolt for padlock
  - 1. Locking Device Assembly: Cremone type, both jamb sides, locking bars, operable from inside with thumbturn.
- L. Counterbalance Type: Torsion spring.
- M. Manual Door Operator: Chain-hoist operator. *(In conjunction with the electric door operator in case of electric failure)*
- N. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day
2. Operator Type: Jackshaft, side mounted
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Exterior, dusty, wet, or humid.
5. Emergency Manual Operation: Chain type.
6. Obstruction-Detection Device: Automatic photoelectric sensor & electric sensor edge on bottom section.
  - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
7. Control Station: Where indicated on Drawings.
8. Other Equipment: Audible and visual signals, Portable, radio-control system.

O. Door Finish:

1. Baked-Enamel or Powder-Coat Finish: Color and gloss as selected by Architect from manufacturer's full range.
2. Finish of Interior Facing Material: Finish as selected by Architect from manufacturer's full range.

## 2.04 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.05 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A653/A653M, with indicated zinc coating and thickness.
1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
  2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.



- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.
- F. Board Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polystyrene or polyurethane board insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84; or with glass-fiber-board insulation. Secure insulation to exterior face sheet. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- G. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- H. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A653/A653M, with indicated thickness.
- I. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

## 2.06 TRANSLUCENT DOOR SECTIONS

- A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; and with overlapped or interlocked weather-resistant seal at meeting rails.
  - 1. Aluminum: ASTM B221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; minimum thickness 0.063 inch for door section 1-3/4 inches deep, and as required to comply with requirements.
  - 2. Reinforce or form trusses within sections as required to stiffen door and for wind loading.
  - 3. Provide reinforcement for hardware attachment.
- B. Translucent Panels: Ribbed, translucent, glass-fiber-reinforced plastic panels, secured and sealed watertight to framing, and reinforced to comply with performance requirements.

## 2.07 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
  - 1. Galvanized Steel: ASTM A653/A653M, minimum G60 zinc coating.
  - 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
  - a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets.
  - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
- C. Windows: Manufacturer's standard window units of type, size, and in arrangement indicated. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door-section frames.

## 2.08 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track and 2-inch- diameter roller tires for 2-inch- wide track.
- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

## 2.09 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  1. Lock Cylinders: Cylinders standard with manufacturer and keyed to building keying system.

- 2. Keys: Three for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

#### 2.010 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A229/A229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.
- C. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- D. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
- E. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- F. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- G. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

#### 2.011 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

## 2.012 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
  - 1. 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. Lift Master
  - 2. Comply with NFPA 70.
  - 3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
  - 1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
  - 1. Electrical Characteristics:
    - a. Phase: 3-phase
    - b. Volts: 208V
    - c. Hertz: 60.
  - 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
  - 3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
  - 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
  - 5. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
    - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
  2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    - a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.
  3. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.
- G. Control Stations: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
    - a. Vehicle Storage Garage:
      - 1) Sectional doors will be opened and shut with the local up/down button located on the interior of the building. (no clickers, or loop detectors)
    - b. Vehicle Maintenance:
      - 1) Sectional doors will be opened and shut with the local up/down button located on the interior of the building. (no clickers, or loop detectors). Provide a bank of door controls in the mechanics office on top of the local controls as well.
    - c. Shops:
      - 1) Each shop will have the local up/down button located next to the doors, Provide wireless clicker as well. Each shop would be set up with a different frequency.
    - d. Wash Bay:
      - 1) Provide the local up/down button located next to the doors, Provide wireless clicker as well.
- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency

manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Portable, Radio-Control System: Consisting of two of the following:
  - 1. Three-channel universal coaxial receiver to open, close, and stop door.
  - 2. Portable control device to open and stop door may be momentary-contact type; control to close door shall be sustained- or constant-pressure type.
  - 3. Remote antenna and mounting kit.

## 2.013 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.014 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

### 3.03 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

### 3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

### 3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

## SECTION 08 43 13

### ALUMINUM-FRAMED STOREFRONTS

#### 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. Aluminum-framed storefront systems including storefront door assemblies.
- 2. Interior & Exterior storefront framing
- 3. Operable Vents
- 4. Insulated Spandrel Panels
- 5. Insulated and non-insulated glazing
  - i. Switchable film tint

##### 1.03 PREINSTALLATION MEETINGS

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

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

- 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
- 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:
  - a. Joinery, including concealed welds.
  - b. Anchorage.
  - c. Expansion provisions.



- d. Glazing.
  - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- F. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Mockup Testing Submittals:
  - 1. Testing Program: Developed specifically for Project.
  - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
  - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data:
  - 1. For Installer and field-testing agency
  - 2. For professional engineer's experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.
- C. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.
- D. Product Test Reports: For aluminum-framed storefronts, for tests performed by a qualified testing agency

- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

#### 1.08 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical wall area as shown on Drawings.

2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
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.

#### 1.09 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on laboratory mockups.
  1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
  2. Size and Configuration: As indicated on Drawings.
  3. Notify Architect ten (10) business days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups in accordance with requirements in "Performance Requirements" Article. Perform the following tests in the following order:
  1. Structural: ASTM E330/E330M at 50 percent of positive test load.
  2. Air Leakage: ASTM E283.
  3. Water Penetration under Static Pressure: ASTM E331.
  4. Water Penetration under Dynamic Pressure: AAMA 501.1.
  5. Structural: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
    - a. Air Leakage: ASTM E283.
    - b. Water Penetration under Static Pressure: ASTM E331.
  6. Thermal Cycling: In accordance with AAMA 501.5. Repeat the following:
    - a. Air Leakage: ASTM E283.
    - b. Water Penetration under Static Pressure: ASTM E331.
  7. Structural: ASTM E330/E330M at 100 and 150 percent of positive and negative test loads. Repeat the following:
    - a. Air Leakage: ASTM E283.
    - b. Water Penetration under Static Pressure: ASTM E331.
- C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

1. Compatibility: Test materials or components using ASTM C1087.
2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
3. Submit no fewer than four pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

#### 1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures, including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. EFCO Corporation.
  - 2. Kawneer Company, Inc.; Arconic Corporation., (Trifab VersaGlaze, 451 UT Series is Basis of Design)
  - 3. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing spandrel panels, venting windows and accessories, from single manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer in the project State, to design aluminum-framed storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings
  - 3. Exposure: As indicated on drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
    - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
  3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
    - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
  2. Maximum Water Leakage: In accordance with AAMA 501.1 Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Seismic Performance: Aluminum-framed storefronts shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.
- I. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):

- a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
  - b. Venting Windows: Whole window U-factor of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
  - c. Swinging Doors: Whole aluminum framed entrance doors with fixed glazing and framing not having an average U-factor or not more than 0.80 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
- 2. Solar Heat Gain Coefficient (SHGC):
  - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.31 as determined in accordance with NFRC 200.
  - b. Venting Windows & Doors: Whole window SHGC of not more than 0.31 as determined in accordance with NFRC 200.
- 3. Air Leakage:
  - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
  - b. Venting Windows: Whole window air leakage of not more than 0.3 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- 4. Condensation Resistance Factor (CRF):
  - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
  - b. Venting Windows: Whole window CRF of not less than 55 as determined in accordance with AAMA 1503.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
  - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
    - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F
    - b. Low Exterior Ambient-Air Temperature: 0 deg F
    - c. Interior Ambient-Air Temperature: 75 deg F
- K. Structural-Sealant Joints:
  - 1. Designed to carry gravity loads of glazing.
- L. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed storefronts without failing adhesively or

cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

## 2.03 ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Storefront Doors,
3. Interior Vestibule Framing Construction: Nonthermal
4. Glazing System: Retained mechanically with gaskets on four sides.
5. Glazing Plane: Center.
6. Finish: High-Performance Organic Finish, Two-Coat PVDF.
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
  - a. Overall Panel Thickness: 1 inch
  - b. Exterior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated
    - 2) Finish: Match framing system
    - 3) Texture: Smooth
    - 4) Backing Sheet: 1/8-inch- thick tempered hardboard
  - c. Interior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated
    - 2) Finish: Matching storefront framing



- 3) Texture: Smooth
  - 4) Backing Sheet: 1/8-inch- thick tempered hardboard
- d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board
  - e. Surface-Burning Characteristics: Comply with ASTM E84; 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: 450 or less.

## 2.04

### ENTRANCE DOORS

- A. Aluminum doors shall be thermally broken extruded aluminum, pre-glazed, single acting, hinged doors, medium stile-and-rail type. Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, the following:
  1. EFCO model "D502 (TS) ThermaStile" door.
  2. Kawneer model: "560 Insulclad" door.
  3. Wausau "Thermal Block, Wide Stile" door.
  4. YKK: "50XT Megatherm Door.
- B. Entrance doors:
  1. Wall thickness of stile and rail extrusions: not less than 0.125 inch.
  2. Wall thickness of glazing stops: not less than 0.050 inch.
  3. Thickness of door: 1-3/4 inches.
  4. Width of door stiles: 5 inches minimum.
  5. Width of top rail: 5 inches minimum.
  6. Width of bottom rail: 10 inches minimum (in conformance with 2012 ADA).
  7. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.
  8. Weatherstripping: Wool pile type.
- C. Hardware shall be furnished under Section 08 71 00 - DOOR HARDWARE and installed by aluminum entrance and storefront framing system manufacturer, conforming to governing laws and building codes.
  1. Install all reinforcing required and prepare doors for finished hardware specified herein below.

## 2.05 PROJECT-OUT WINDOWS

- A. Project-Out windows (vents) in storefront system.
  - 1. Thermally broken, structural silicone glazed, 3 inch nominal deep frame, project- out window.
    - a. Kawneer “GLASSvent UT” system.
    - b. EFCO “WV410” system.
    - c. YKK AP America: “YOW 225” system.
  - 2. Materials
    - a. Extruded aluminum profiles shall be 6063-T5 alloy and temper (ASTM B221 G.S. 10A-T5).
    - b. The frame adaptor depth shall be not less than 2 1/4 inches: The ventilator depth shall not be less than 2 inches.
    - c. All framing members shall have minimum wall thickness of 0.125 inch and shall provide the structural strength sufficient to meet the specified performance requirements.
    - d. All ventilators shall be tubular.
    - e. Weatherstripping shall be resilient elastomer.
    - f. All references to dimensions for wall thicknesses and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.
  - 3. Hardware:
    - a. Stainless Steel 4-Bar Hinges.
    - b. Cast White Bronze Cam Locking Handles.
  - 4. Accessories: Provide insect screens for all operable windows in storefront system.

## 2.04 GLAZING

- A. A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
  - 1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
- B. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.
  - 1. Insulating glass shall not experience fogging, wetting or staining

within the sealed space, spacer corrosion, spacer migration, adhesive or cohesive failure of primary or secondary edge seal.

2. Insulating glass shall not experience decrease in the air space dimension due to chemical reaction of desiccant with entrapped air. Size of insulating glass spacer shall be calculated according to the pressure differential of the inboard and outboard glass sheets in opposite directions of each unit to prevent contact between the glass sheets in the center of the large insulated glazing units.
3. The insulating glass dimensional tolerances shall conform to the following:
  - a. Edge length: +0.12" (3mm), -0.08" (-2mm).
  - b. Thickness (with tempered glass): +0.08" (2mm), -0.06" (-1mm).
  - c. Thickness (with laminated glass):  $\pm 0.06$ " (.15mm).
4. Insulating glass spacers shall be high performance stainless steel with mill finish, or warm edge to meet requirements in Performance Requirements article indicated herein and Section 08 43 13.

C. Glass types and locations:

1. General: For locations of glass types, comply with the following descriptions and refer to Door Schedule, Interior Elevations and Exterior Elevations for additional locations, and as additionally noted on Drawings.
  - a) Glass type A - Insulated "Low-E" glass units:
    - a. Typical all window locations, except where others are indicated.
2. *Glass Type A*: Insulated "Low-E," glass 1-inch-thick units:
  - a) Components
    - a. Outer layer: 1/4 inch (6 mm) thick glass, Viracon Inc., color "Clear" with Low-E sputter coating on number 2 surface.
    - b. Inner layer: 1/4 inch (6 mm) thick clear heat strengthened glass.
    - c. Air space: 1/2 inch (13 mm) thick.
    - d. Gas fill: 90% Argon/10% Air.
  - b) Performance Requirements: Glass units shall be equal to Viracon "Solarscreen Low E Clear VE 1-2M". having the following performance characteristics:
    - Visible transmittance: 70 percent
    - Shading coefficient: 0.43
    - Relative heat gain: 89
    - Solar transmittance: 33 percent
    - Reflectance (Visible out): 11 percent
    - Reflectance (Visible in): 12 percent
    - Solar reflectance: 31 percent
    - U Value (Winter / Summer): 0.25 / 0.21

3. *Glass Type B*: Insulated “Low-E,” glass 1-inch-thick units, tempered:
  - a) Components
    - a. Outer layer: 1/4 inch (6 mm) thick full tempered glass, Viracon Inc., color “Clear” with Low-E sputter coating on number 2 surface.
    - b. Inner layer: 1/4 inch (6 mm) thick clear full tempered glass.
    - c. Air space: 1/2 inch (13 mm) thick.
    - d. Gas fill: 90% Argon/10% Air.
  - b) Performance Requirements: Same as Glass Type A, above.
4. *Glass Type C*: 1-inch-thick insulated spandrel glass units.
  - a) Components
    - a. Outer layer: 1/4 inch (6 mm) thick tempered / heat strengthened spandrel glazing.
    - b. Inner substrate: Tempered Hardboard
    - c. Polystyrene Insulated Core: Min U-Value of 0.22
    - d. Color to be selected from Manufacturer’s full range of colors.
5. *Glass Type D*: Clear tempered safety glass: 1/4 inch thick.
6. *Glass Type E*: Switchable window tint (*Film on top of Glass Type D*)
  - a. Thickness: 0.4 MM
  - b. Visible Angle: 160 Degree
  - c. UV Block: 99%
  - d. Acceptable Manufacturers: Subject to compliance with the requirements
  - e. Specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - i. ElectraTint
  - f. Color Options: From manufacturer’s full selection of colors.
  - g. Provide other material, not specifically described but required for a complete and proper installation, as specified or selected by the Contractor subject to the approval of the Architect
  - h. See low voltage accessories for additional controllers and information regarding low voltage items for the glazing.

## 2.05 GLAZING SEALANTS

- A. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- B. Glazing Sealants: As recommended by manufacturer.

- C. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
  - 1. Color: As selected by Architect from manufacturer's full range of colors
- D. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
  - 1. Color: Match structural sealant.

## 2.06 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- D. Structural Profiles: ASTM B308/B308M.
- E. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- F. 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.

## 2.07 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing compatible with adjacent materials
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- E. Rigid PVC Filler.

## 2.08 LOW VOLTAGE ACCESSORIES

### A. CE & UL Certified Controller:

- 1. Operating Voltage: 65 VAC or 75 VAC
- 2. Rated Power: 100W
- 3. Rated Ampere: 2A
- 4. Input Voltage: AC 110 / 120V
- 5. Output Voltage: AC60VAC

- B. Provide power remote control for window film tint.

## 2.09 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

#### 2.010 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

#### 2.011 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.

- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

### 3.03 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

### 3.04 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior, or interior as specified.
- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturers written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."



### 3.05 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

### 3.06 ERECTION TOLERANCES

- A. Install aluminum-framed storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
  - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed storefronts.
  - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
    - a. Perform a minimum of two tests in areas as directed by Architect.
    - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
  - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
    - a. Perform a minimum of two tests in areas as directed by Architect.
    - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion

3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- C. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
    1. Test a minimum of two areas on each building facade.
    2. Repair installation areas damaged by testing.
  - D. Aluminum-framed storefronts will be considered defective if they do not pass tests and inspections.
  - E. Prepare test and inspection reports.

END OF SECTION

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## SECTION 08 45 13

### STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

#### 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 aluminum-framed assemblies glazed with structured-polycarbonate panels as follows:
  - 1. Wall assemblies.

##### 1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- C. Samples: In manufacturer's standard size.
  - 1. For each type of structured-polycarbonate panel.
  - 2. For each type of exposed finish for framing members.
- D. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:
  - 1. Joinery.
  - 2. Anchorage.
  - 3. Expansion provisions.

4. Structured-polycarbonate panels.
5. Flashing and drainage.

- E. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For each structured-polycarbonate-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For structured-polycarbonate-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  1. Build mockup of typical panel assemblies as shown on Drawings.
  2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Water leakage.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace structured-polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.
- 1. Defects include, but are not limited to, the following:
    - a. Delamination.
    - b. Color changes exceeding requirements.
    - c. Losses in light transmission beyond 6 percent from original when measured according to ASTM D1003.
  - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
- 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
  - 2. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design structured-polycarbonate-panel assemblies.
- B. Structural Loads: As indicated on Drawings
- C. Deflection Limits:
  - 1. Vertical Panel Assemblies: Limited to  $L/175$  of clear span for each assembly component.
- D. Structural-Test Performance: Panel assemblies tested according to ASTM E330, as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
  - 2. When tested at 165 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

- E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 15 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
- F. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
  - 1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- G. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- H. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
  - 1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  - 2. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas shall have an SHGC of no greater than .39 as determined according to NFRC 200.
  - 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..

## 2.02 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

- A. Structured-Polycarbonate-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with structured-polycarbonate panels.
  - 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. Duo-Gard Industries Inc.
    - b. Gallina USA, LLC.
    - c. Duralight Plastics - Thermoclick

## 2.03 STRUCTURED-POLYCARBONATE PANELS

- A. Structured-Polycarbonate Panels: Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
- B. Panel Thickness: Nominal 1-9/16" (40 mm)
- C. UV Resistance: On both surfaces
- D. Color: As selected by Architect from manufacturer's full range
- E. Panel Performance:
  - 1. Plastic Self-Ignition Temperature: 650 deg F or more according to ASTM D1929.
  - 2. Smoke-Developed Index: 450 or less according to ASTM E84, or 75 or less according to ASTM D2843.
  - 3. Combustibility Classification: Class CC1 based on testing according to ASTM D635.
  - 4. Roof-Covering Classification: Class A according to ASTM E108 or UL 790.
  - 5. Interior Finish Classification: Class A based on testing according to ASTM E84.
  - 6. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.
    - a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
  - 7. Impact Resistance: No failure at impact of [200 ft. x lbf according to freefalling-ball impact test using a 3-1/2-inch-diameter, 6.3-lb ball] <Insert requirements>.
  - 8. Haze Factor: Greater than 90 percent when tested according to ASTM D1003.

## 2.04 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
  - 1. Construction: Thermally broken, extruded aluminum
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
  - 1. Sheet and Plate: ASTM B209.
  - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
  - 3. Extruded Structural Pipe and Tubes: ASTM B429.
  - 4. Structural Profiles: ASTM B308.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A193, 300 series stainless-steel screws.
  2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.
- F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.
- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than 0.050-inch-thick, finished to match framing.
- I. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.
- J. Frame-System Sealants: As specified in Section 07 92 00 "Joint Sealants."
- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.05 FABRICATION

- A. Fabricate aluminum 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. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.
- B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- C. Reinforce aluminum components as required to receive fastener threads.

## 2.06 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range



## PART 3 - EXECUTION

### 3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
  - 1. Do not install damaged components.
  - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
  - 3. Rigidly secure nonmovement joints.
  - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
  - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
  - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
  - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

### 3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - 1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
  - 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E1105.

- a. Static-Air-Pressure Difference: 6.24 psf
  - b. Water Penetration: None.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION

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SECTION 08 80 00

GLAZING  
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, applicable parts of Division 0- Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings:

***Volume I Drawings Below:***

***General:*** G000, G001, G101, G102, G201, G202, G301

***Architectural:*** A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A112, A113A, A113B, A113C, A201, A211, A212, A213, A221, A231, A301, A302, A401, A402, A403, A404, A411, A412, A601, A602, A611, A612, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841

***Volume II Drawings Below:***

***None for this Filed Sub-Bid***

- D. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- E. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION FOR BID AND INSTRUCTIONS TO BIDDERS.
  - 1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER:

SUB-BID FOR TRADE:

\_\_\_\_\_  
Glass & Glazing

2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Filed Sub-Bid.

#### 1.02 EXAMINATION OF SITE AND DOCUMENTS:

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

#### 1.03 SEQUENCING:

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

#### 1.04 SCAFFOLDS AND STAGING:

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
  1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.

2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

1.05 HOISTING MACHINERY AND EQUIPMENT:

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

1.06 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

A.

1.07 RELATED DOCUMENTS

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

1.08 SUMMARY

- A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.
- 7.

#### 1.09 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### 1.010 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.011 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

#### 1.012 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
  - 1. Tinted glass.
  - 2. Coated glass.
  - 3. Laminated glass.
  - 4. Insulating glass.
  - 5. Spandrel glass.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

#### 1.013 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of fabricated glass units, glass testing agency and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

#### 1.014 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors[ and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program].
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Install glazing in mockups specified in Section 08 51 13 "Aluminum Windows" to match glazing systems required for Project, including glazing methods.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.015 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than two (2) Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

#### 1.016 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

#### 1.017 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

#### 1.018 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of



insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
  - 1. Design Wind Pressures: As indicated on Drawings
    - a. Wind Design Data: As indicated on Drawings.
    - b. Basic Wind Speed: As indicated on Drawings
    - c. Importance Factor: As indicated on Drawings
    - d. Exposure Category: As indicated on Drawings
  - 2. Design Snow Loads: As indicated on Drawings.
  - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
  - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
  - 2. For laminated-glass lites, properties are based on products of construction indicated.
  - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
  - 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
  - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

## 2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
  - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
  - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
  - 1. Minimum Glass Thickness for Exterior Lites: ¼"
  - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance

Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.04 GLASS PRODUCTS

### A. Glass types and locations:

1. General: For locations of glass types, comply with the following descriptions and refer to Door Schedule, Interior Elevations and Exterior Elevations for additional locations, and as additionally noted on Drawings.
  - a) Glass type 4 - Insulated "Low-E" glass units:
    - a. Typical all window locations, except where others are indicated.
2. *Glass Type 1* – Clear tempered safety glass: 1/4 inch thick.
3. *Glass Type 2*: Nominal 1/4 inch thick laminated glass.
  - a) Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
  - b) Interlayer: 0.030 inch thick translucent clear polyvinyl butyl innerlayer
  - c) Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass.
4. *Glass Type 3*: 8mm-9 mm thick (5/16 inch-3/8 inch) transparent wire-less fire rated ceramic glazing material with polished finish.
  - a) Acceptable Manufacturers: Subject to compliance with the requirements
  - b) Specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - a. Nippon Electric Glass Co., Ltd., "Firelite Plus".
    - b. Vetrotech Saint-Gobain, "SSG Keralite FR-L".
    - c. SAFTI First, "Pyran Platinum L".
  - c) For fire rated door assemblies, conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257.
    - Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings. Permanently identify each individual glazing unit with a listing mark visible after
  - d) Installation.
    - In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.
5. *Glass Type 4*: Insulated "Low-E," glass 1 inch thick units:
  - a) Components
    - a. Outer layer: 1/4 inch (6 mm) thick tempered glass, Viracon Inc., color "Clear" with Low-E sputter coating on number 2 surface.
    - b. Inner layer: 1/4 inch (6 mm) thick clear tempered glass.
    - c. Air space: 1/2 inch (13 mm) thick.
    - d. Gas fill: 90% Argon/10% Air.

- b) Performance Requirements: Glass units shall be equal to Viracon “Solarscreen Low E Clear VE 1-2M”. having the following performance characteristics:
  - a. Visible transmittance: 70 percent
  - b. Shading coefficient: 0.43
  - c. Relative heat gain: 89
  - d. Solar transmittance: 33 percent
  - e. Reflectance (Visible out): 11 percent
  - f. Reflectance (Visible in): 12 percent
  - g. Solar reflectance: 31 percent
  - h. U Value (Winter / Summer): 0.25 / 0.21

6. *Glass Type 5*: Frosted tempered safety glass, ¼ inch thick.

7. *Glass Type 6*: Switchable window tint (*Film on top of Glass Type 2*)

- a. Thickness: 0.4 MM
- b. Visible Angle: 160 Degree
- c. UV Block: 99%
- d. Acceptable Manufacturers: Subject to compliance with the requirements
- e. Specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - i. ElectraTint
- f. Color Options: From manufacturer’s full selection of colors.
- g. Provide other material, not specifically described but required for a complete and proper installation, as specified or selected by the Contractor subject to the approval of the Architect
- h. See low voltage accessories for additional controllers and information regarding low voltage items for the glazing.

## 2.05 GLAZING SEALANTS

### A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

- B. Neutral-Curing Silicone Glazing Sealant, Class 150/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
  - 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. Pecora Corporation.
    - b. Sika Corporation.
    - c. Tremco Incorporated.
  - 2. Applications: Exterior Glazed Doors & Lites
- C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.
  - 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. Pecora Corporation.
    - b. Sika Corporation.
    - c. Tremco Incorporated.
  - 2. Applications: Interior Glazed Doors & Lites

## 2.06 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.
  - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.07 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for

application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
  - 1. Neoprene with Shore A durometer hardness of 85, plus or minus 5.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
  - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
  - 1. Neoprene with Shore A durometer hardness per manufacturer's written instructions.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. No Draft Speak-Thru: Satin Anodized Aluminum 5-5/16" No Draft Speak-Thru, Satin Anodized Aluminum. Equal to CRL, Item #834A or approved equal.

## 2.08 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## 2.09 LOW VOLTAGE ACCESSORIES

- A. CE & UL Certified Controller:
  - 1. Operating Voltage: 65 VAC or 75 VAC

2. Rated Power: 100W
3. Rated Ampere: 2A
4. Input Voltage: AC 110 / 120V
5. Output Voltage: AC60VAC

B. Provide power remote control for window film tint.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep systems.
  3. Minimum required face and edge clearances.
  4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

### 3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.



- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.05 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.06 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.07 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

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## SECTION 08 91 19

### FIXED LOUVERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes fixed extruded-aluminum louvers for exterior and interior applications.

##### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: For each type of metal finish required.
- D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

##### 1.03 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.
- B. Sample warranties.

##### 1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 1.05 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
- C.
  - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. acting inward or outward.
- D. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
- E.
  - 1. Component Importance Factor: 1.5
- F. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

### 2.02 FIXED EXTRUDED-ALUMINUM LOUVERS (EXTERIOR)

- A. Horizontal, Wind-Driven-Rain-Resistant Louver
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Airolite Company, LLC (The).
    - b. Greenheck Fan Corporation.
    - c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
    - d.
  - 2. Louver Depth: 6 inches minimum

3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
4. Louver Performance Ratings:
  - a. Free Area: Not less than 7.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
  - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 300 fpm
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.03 FIXED EXTRUDED-ALUMINUM LOUVERS (INTERIOR)

- A. Interior louvers: 4 inch deep fixed-blade unit, equal to Airolite Company, Marietta OH, Model: K666 or approved equal, meeting the following requirements:
  1. Size: As indicated.
  2. Fabricate louver assembly with single frame, divide inside of frame into three equal parts with two intermediate vertical mullions. Center section shall be louvered with removable insect screen on the inside. Flanking sections shall be fabricated to receive fixed glass.
  3. Free area requirement: 45 percent, minimum
  4. Louver blade design: Sloped at 30 degrees, reinforced with intermediate stiffeners, material thickness of 0.081- inches minimum.
  5. Louver frame: Channel shape, mechanically welded corner joints, material thickness of 0.81-inches, with extended sill frame.

## 2.04 LOUVER SCREENS

- A. General: Provide screen at each exterior louver
  1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type: Bird screening and insect screening
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Aluminum Louvers:
  1. Bird Screening: Stainless steel, 1/2-inch-square mesh, 0.047-inch wire.
  2. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

## 2.05 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  - 3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
  - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.06 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.07 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range

# PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

### 3.02 ADJUSTING

- A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

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SECTION 09 00 01  
RESILIENT FLOORS FILED SUB-BID REQUIREMENTS  
(FILED SUB-BID REQUIRED)

**PART 1 - GENERAL**

**1.01 GENERAL PROVISIONS**

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 0 – Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the filed sub-bid “Resilient Floors” include all of the following listed Specification Sections: in their entirety:
- 1. Section 09 00 01 – RESILIENT FLOORS FILED SUB-BID REQUIREMENTS.**
  - 2. Section 09 65 13 – RESILIENT BASE AND ACCESSORIES**
  - 3. Section 09 65 19 – RESILIENT TILE FLOORING**
  - 4. Section 09 65 66 – RESILIENT ATHLETIC FLOORING**
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

***Volume I Drawings Below:***

***General:*** G000, G001, G101, G102, G201, G202, G301

***Structural:*** S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S301, S302, S303, S304, S305, S306, S901

***Architectural:*** A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A601, A602, A611, A612, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841, A901, A911, A912, A913

***Plumbing:*** P000, P101A, P101B, P101C, P111A, P111B, P111C, P401, P402, P403

***HVAC:*** H001, H200C, H201A, H201B, H201C, H401

***Electrical:*** E001, E211A, E211B, E211C, FA001, FA111A, FA111B, FA111C, TC001, TC111A, TC111B, TC111C

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.



F. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTION TO BIDDERS.

1. The following shall appear on the upper left hand corner of the envelope:

2.

NAME OF SUB-BIDDER:

SUB-BID FOR TRADE:

RESILIENT FLOORS

3. Each sub-bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit.

G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

## 1.02 EXAMINATION OF SITE AND DOCUMENTS

A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

## 1.03 SEQUENCING

A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

## PART 2 - PRODUCTS

### 2.01 SCAFFOLDS AND STAGING

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
  2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
  3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
  4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

## 2.02 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

## PART 3 - EXECUTION

### 3.01 DAILY CLEANUP

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

END OF SECTION

SECTION 09 05 06  
COMMON WORK RESULTS FOR FLOORING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.01 SUMMARY

- A. This Section includes general requirements for flooring preparation, installation and temporary protection for flooring systems.
  - 1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
  - 2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
    - a. Grinding down high spots of substrate.
    - b. Providing Portland cement-based latex underlayment (filler).

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- B. Section 09 30 13 – CERAMIC TILE.
- C. Section 09 65 43 - LINOLEUM FLOORING.
- D. Section 09 67 23 - RESINOUS FLOORING.
- E. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

1.03 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. ASTM D 4259 - Standard Practice for Abrading Concrete.
  - 2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
4. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F 1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
6. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
7. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
8. ASTM F 3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

##### B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 19.23 – CONSTRUCTION MEETINGS. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

##### 1. Required attendees:

- a. Engineer
- b. General Contractor.
- c. Project Superintendents representing each floor system installer.
- d. Manufacturer's technical representative(s) for flooring products as designated by Engineer or Contractor.
- e. Representatives of related trades as directed by the Engineer or Contractor, and representatives for installers of related work specified under the following Sections:
  - 1) Section 09 30 13 – Ceramic Tile.
  - 2) Section 09 65 43 - Linoleum Flooring.
  - 3) Section 09 67 23 - Resinous Flooring.
  - 4) Section 09 68 13 – Tile Carpeting.

##### 2. Agenda:

- a. Scheduling of preparation and flooring operations.

- b. Procedures for testing of relative humidity and moisture content of in situ substrates.
- c. Water vapor emission control methods.
- d. Review of staging and material storage locations.
- e. Coordination of work by other trades.
- f. Protection of completed Work.
- g. Establish humidity and temperature limitations for performing the work, to which Engineer and Contractor must agree.
- h. Discuss process for inspection and acceptance of completed Work of this Section.

C. Sequencing:

- 1. Sequence work to ensure flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
- 2. Field Measurements
  - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
  - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
- 3. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

## 1.05 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:

- 1. Test and Evaluation Reports: Include the following:
  - a. Report the Test Deployment Parameters at start of testing and finishing of testing:
    - 1) Start and finish dates and times of testing.
    - 2) Ambient temperature,
    - 3) Ambient relative humidity and dew point temperature.
    - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
  - b. Report the "Factor" used to calculate the actual test area of the Calcium Chloride test site.
  - c. Report the concrete slab thickness (in inches).
  - d. Report all test results in chart form listing the following:
    - 1) Test locations (also mark test locations on floor plan)
    - 2) Surface Temperature of Concrete
    - 3) pH Paper/ Pencil Reading (ASTM F 710)
    - 4) Visual Appearance of Concrete

- 5) Concrete Slab Age
  - 6) Relative Humidity in Concrete, % (ASTM F 2170):
    - a) Depth of hole from top of Slab, in.
    - b) RH in concrete, %
    - c) Temp. in concrete, °F
  - 7) Surface Moisture Meter Test (ASTM E 1907):
    - a) 1. Electrical Impedance Test Values or
    - b) 2. Electrical Resistance Test Values
  - 8) Moisture Vapor Emission (MVER) - CaC12 Test (ASTM F 1869):
    - a) Weight Gain in grams
    - b) Exposure Time/hrs
    - c) MVER lbs./1,000 sq. ft./24 hours
  - e. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

#### 1.06 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) testing for concrete slabs and floors.
1. Contractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Contractor, flooring subcontractors and Owner's Project Representative.
    - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
      - 1) Resinous flooring and seamless flooring of all types.
      - 2) Painted floors and concrete sealers.
      - 3) Carpet tile.
    - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
  2. Testing Requirements: As specified under Part 3 of this Section.
    - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.
      - 1) Perform additional testing after procedures have been performed by the Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

## PART 2 - PRODUCTS

### 2.01 GENERAL FLOORING ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
  - 1. Ardex Americas, Aliquippa, PA., products “Feather Flash” and “Ardex SD-P”.
  - 2. Quikrete Companies., Atlanta, GA., product “Fast-Set Underlayment 1248”.
  - 3. Silpro Corp., Ayer MA., product “Profinish”.
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
  - 1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
    - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
    - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
    - c. VOC content: Less than 50 g/L.
  - 2. Acceptable manufacturers, or approved equal:
    - a. Advanced Adhesive Technology, Inc, Dalton GA.
    - b. DAP Incorporated, Dayton OH.
    - c. W.W. Henry Company, Aliquippa PA.
    - d. Roberts Consolidated Industries, Inc., City of Industry, CA.
    - e. Or adhesive recommended by flooring manufacturer for performance and compliance with warranty requirements.

### 2.02 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
  - a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
  - 1. pH test paper.
  - 2. Distilled or de ionized water.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
  - 1. Substrates shall be dry and clean.
  - 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
  - 3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual flooring Specification Sections.
  - 4. Temperature of flooring and substrate shall be within specified tolerances as required by flooring and adhesive manufacturers.
  - 5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete:
  - 1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
  - 2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
  - 3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
  - 4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

### 3.02 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
  - 1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.
- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.



### 3.03 TESTING IN SITU CONCRETE SUBSTRATES

#### A. Scope:

1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.

#### B. Scheduling:

1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
  - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.

#### C. Test result submittals:

1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
2. List test locations on chart and show same on marked up Floor Plan Drawings.
3. Submit results in duplicate. Deliver copies directly to Engineer, Owner's Project Representative and Construction Manager General Contractor.

#### D. Testing Procedures, quantification of Relative Humidity

1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting these criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be Included with the test report.
2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the inserted test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
  - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
  - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
4. Vacuum all concrete dust from test hole.

5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
  6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
  7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
  8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
  9. Read and record temperature and relative humidity at the test site.
- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting these criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
  2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 In the first 1,000 square feet and 1 per each additional 1,000 square feet.
  3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
  4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
  5. Expose Calcium Chloride and set dish on concrete surface.
  6. Install test containment dome and allow test to proceed for 60 to 72 hours.
  7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
  8. Weigh test dish on site recording weight and stop time.
  9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
    - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
    - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
    - c. Allow the water to set for approximately 60 seconds.

- d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
  2. Record and report results.
- G. Testing Procedures:
1. Initial testing: Provide 3 tests for the first 1,000 square feet.
  2. Add one test for each additional 1,000 square feet.
  3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
  4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
  5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
  6. After completion of tests submit 2 copies of test data to the Engineer. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
  7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

### 3.04 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
  1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
  2. Remove, by light sanding and grinding, all protruding edges, high spots.
  3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
  4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
  5. For concrete substrates:
    - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
    - b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.

- C. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- D. Apply primers as recommended by adhesive manufacturer's written instructions.
- E. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

### 3.05 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
  - 1. Apply primers as recommended by adhesive manufacturer's written instructions.

### 3.06 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1,000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Engineer.

### 3.07 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

END OF SECTION

## SECTION 09 21 16.23

### GYPSUM BOARD SHAFT WALL ASSEMBLIES

#### 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. Gypsum board shaft wall assemblies.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

##### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

##### 1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

### 2.02 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated on Drawings
- B. STC Rating: 51, minimum, and as indicated on drawings in assembly.
- C. Gypsum Shaftliner Board:
  - 1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.
    - 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) Georgia-Pacific Gypsum LLC.
      - 2) USG Corporation.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
  - 1. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
  - 1. Depth: As indicated
  - 2. Minimum Base-Metal Thickness: 0.030 inch or as indicated in required assembly
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
  - 1. Minimum Base-Metal Thickness: Matching steel studs
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly

indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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. ClarkDietrich.
- b. SCAFCO Steel Stud Company; Stone Group of Companies.
- c. Steel Network, Inc. (The).

- H. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- I. Finish Panels: Gypsum board as specified in Section 09 29 00 "Gypsum Board."

## 2.03 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
  2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."
- G. Gypsum Board Cants:
  1. Gypsum Board Panels: As specified in Section 09 29 00 "Gypsum Board," Type X, 5/8-inch panels.
  2. Adhesive: Laminating adhesive as specified in Section 09 29 00 "Gypsum Board."

3. Non-Load-Bearing Steel Framing: As specified in Section 09 22 16 "Non-Structural Metal Framing."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
  1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
  2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.



- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.
  - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
  - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.03 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

## SECTION 09 22 16

### NON-STRUCTURAL METAL FRAMING

#### 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. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

###### B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior non-load-bearing wall studs; and ceiling joists.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

##### 1.05 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft.

### 2.02 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
  - 2. Protective Coating: ASTM A653/A653M, G40 hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
  - 1. Steel Studs and Tracks:
    - 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) ClarkDietrich.
      - 2) Marino\WARE.
      - 3) Steel Construction Systems.
    - b. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection
    - c. Depth: As indicated on Drawings
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch vertical movement.
    - 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) CEMCO; California Expanded Metal Products Co.
  - 2) ClarkDietrich.
  - 3) Marino\WARE.
2. Single Long-Leg Track System: ASTM C645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
  4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. 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) CEMCO; California Expanded Metal Products Co.
      - 2) ClarkDietrich.
      - 3) Steel Construction Systems.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
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. CEMCO; California Expanded Metal Products Co.
    - b. ClarkDietrich.
    - c. Steel Construction Systems.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. ClarkDietrich.
    - b. Marino\WARE.
    - c. Steel Construction Systems.
  2. Minimum Base-Steel Thickness: 0.0329 inch
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

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. ClarkDietrich.
    - b. SCAFCO Steel Stud Company.
    - c. Steel Construction Systems.
  2. Depth: As indicated on Drawings
  3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
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. ClarkDietrich.
    - b. SCAFCO Steel Stud Company.
    - c. Steel Construction Systems.
  2. Minimum Base-Steel Thickness: .0329 inch
  3. Depth: As indicated on Drawings
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
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. ClarkDietrich.
    - b. MRI Steel Framing, LLC.
    - c. SCAFCO Steel Stud Company.
  2. Configuration: Asymmetrical or hat shaped
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings
  2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
  3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. ClarkDietrich.
  - b. Marino\WARE.
  - c. Steel Construction Systems.

## 2.03 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
  1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58 or AC308 as appropriate for the substrate.
    - a. Uses: Securing hangers to structure.
    - b. Type: torque-controlled, adhesive anchor or adhesive anchor
    - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
    - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
  2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  1. Depth: As indicated on Drawings
- F. Furring Channels (Furring Members):
  1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
  2. Steel Studs and Tracks: ASTM C645.
    - a. Minimum Base-Steel Thickness: 0.0329 inch
    - b. Depth: As indicated on Drawings
  3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
    - a. Minimum Base-Steel Thickness:.0190 inch
    - b. Depth: As indicated on Drawings

4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
  - a. Minimum Base-Steel Thickness: 0.0329 inch
5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
  - a. Configuration: Asymmetrical or hat shaped
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
  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. Armstrong Ceiling & Wall Solutions.
    - b. Certainteed; SAINT-GOBAIN.
    - c. USG Corporation.

## 2.04 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building

structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.04 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.



- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  - 6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
  - 1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.05 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 24 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within [performance limits established by referenced installation standards] <Insert deflection limit>.
  3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

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## SECTION 09 29 00

### GYPSUM BOARD

#### 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. Interior gypsum board.

- B. Related Requirements:

- 1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Gypsum wallboard.
  - 2. Gypsum board, Type X.
  - 3. Gypsum ceiling board.
  - 4. Mold-resistant gypsum board.
  - 5. Interior trim.
  - 6. Joint treatment materials.
  - 7. Sound-attenuation blankets.
  - 8. Acoustical sealant.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

- C. Samples for Initial Selection: For each type of trim accessory indicated.

- D. Samples for Verification: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

#### 1.04 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Build mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
    - b. Each texture finish indicated.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.06 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.

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 Gypsum.
  - b. Armstrong Ceiling & Wall Solutions.
  - c. Georgia-Pacific Gypsum LLC.
  - d. USG Corporation.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered

- B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Gypsum.
  - b. Georgia-Pacific Gypsum LLC.
  - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
  - d. USG Corporation.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered

- C. Gypsum Ceiling Board: ASTM C1396/C1396M.

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 Gypsum.
  - b. Georgia-Pacific Gypsum LLC.
  - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

- D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Gypsum.
  - b. Georgia-Pacific Gypsum LLC.
  - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
  - d. USG Corporation.
2. Core: As indicated.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

#### 2.04 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum.
    - b. Georgia-Pacific Gypsum LLC.
    - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    - d. USG Corporation.
  2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
  3. Long Edges: Tapered.

#### 2.05 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.

#### 2.06 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. .

## 2.07 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.



- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.03 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated
2. Type X: As indicated on Drawings & Where required for fire-resistance-rated assembly
3. Ceiling Type: Ceiling surfaces
4. Mold-Resistant Type: In restrooms, locker rooms, janitor closets
5. Type C: Where required for specific fire-resistance-rated assembly indicated

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.

2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

### 3.04 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. Bullnose Bead: Use where indicated.
  3. LC-Bead: Use at exposed panel edges.
  4. L-Bead: Use where indicated.
  5. U-Bead: Use where indicated.

### 3.05 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Where indicated on Drawings.
  3. Level 3: Where indicated on Drawings.
  4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 09 90 00 "Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 30 13  
CERAMIC TILING  
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, applicable parts of Division 0- Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings:

***Volume I Drawings Below:***

***General:*** G000, G001, G101, G102, G201, G202, G301

***Structural:*** S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S301, S302, S303, S304, S305, S306, S901

***Architectural:*** A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A601, A602, A611, A612, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841, A901, A911, A912, A913

***Plumbing:*** P000, P101A, P101B, P101C, P111A, P111B, P111C, P401, P402, P403

***HVAC:*** H001, H200C, H201A, H201B, H201C, H401

***Electrical:*** E001, E211A, E211B, E211C, FA001, FA111A, FA111B, FA111C, TC001, TC111A, TC111B, TC111C

- D. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.

- E. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION FOR BID AND INSTRUCTIONS TO BIDDERS.

1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER:

SUB-BID FOR TRADE:

TILE

2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Filed Sub-Bid.

#### 1.02 EXAMINATION OF SITE AND DOCUMENTS:

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

#### 1.03 SEQUENCING:

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

#### 1.04 SCAFFOLDS AND STAGING:

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.

1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

1.05 HOISTING MACHINERY AND EQUIPMENT:

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

1.06 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

1.07 RELATED DOCUMENTS

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

1.08 SUMMARY

- A. Section Includes:
  1. Glazed Ceramic wall tile, backsplash
  2. Glazed wall tile.
  3. Glazed porcelain floor tile
  4. Stone thresholds.
  5. Tile backing panels.
  6. Setting Materials (Mortar)
  7. Grout

8. Waterproof membrane for thinset applications
9. Crack isolation membrane.
10. Metal edge strips.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for cementitious backer units

1.09 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Face Size: Actual tile size, excluding spacer lugs.
- D. Module Size: Actual tile size plus joint width indicated.

1.010 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site
  1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.011 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
  1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.



2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

#### 1.012 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting product and certified porcelain tile

#### 1.013 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.
  2. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each type, composition, and color indicated.

#### 1.014 QUALITY ASSURANCE

- A. Installer Qualifications:
  1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Build mockup of each type of wall tile installation.
  2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.015 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.016 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Stone thresholds.
  - 2. Waterproof membrane.
  - 3. Crack isolation membrane.
  - 4. Cementitious backer units.
  - 5. Metal edge strips.

#### 2.02 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  1. Where tile is indicated for installation [in swimming pools] [on exteriors] [or] [in wet areas], do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.03 TILE PRODUCTS

- A. Ceramic Tile Type: Factory-mounted glazed ceramic tile, backsplash
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Basis of Design shown in drawings is *"Color Wheel Collection, Glazed Ceramic, Classic"* as manufactured by Dal-Tile.
    - a. American Olean; a brand of Dal-Tile Corporation.
    - b. Crossville, Inc.
    - c. Daltile; a brand of Dal-Tile Corporation.
  2. Composition: Porcelain
  3. Module Size: 3 inches x 6 inches
  4. Thickness: 5/16 inch.
  5. Face: Plain, with cushion edges.
  6. Surface: Smooth abrasive admixture.
  7. Dynamic Coefficient of Friction: Not less than 0.42.
  8. Finish: Bright, opaque glazed
  9. Tile Color and Pattern: As selected by Architect from manufacturer's full range
  10. Grout Color: As selected by Architect from manufacturer's full range
- B. Ceramic Tile Type: Glazed wall tile, Restrooms
  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, Basis of Design shown in drawings is *"Color Wheel Collection, Glazed Ceramic, Linear"* as manufactured by Dal-Tile.
    - a. American Olean; a brand of Dal-Tile Corporation
    - b. Daltile; a brand of Dal-Tile Corporation.

- c. Crossville, Inc.
- 2. Composition: Porcelain
- 3. Module Size: 4 inches x 12 inches
- 4. Thickness: 5/16 inch.
- 5. Face: Plain with cushion edges
- 6. Surface: Smooth abrasive admixture.
- 7. Dynamic Coefficient of Friction: Not less than 0.42.
- 8. Finish: Bright, opaque glazed.
- 9. Tile Color and Pattern: As selected by Architect from manufacturer's full range
- 10. Grout Color: As selected by Architect from manufacturer's full range

C. Porcelain Tile Type: Glazed floor tile, Admin Restrooms, and Vestibule

- 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, Basis of Design shown in drawings is *"Rhetoric, Glazed Porcelain Floor Tile"* as manufactured by Dal-Tile.
  - a. American Olean; a brand of Dal-Tile Corporation
  - b. Daltile; a brand of Dal-Tile Corporation.
  - c. Crossville, Inc.
- 2. Composition: Porcelain
- 3. Module Size: 12 inches x 24 inches
- 4. Thickness: 5/16 inch.
- 5. Face: Plain with cushion edges
- 6. Surface: Smooth abrasive admixture.
- 7. Dynamic Coefficient of Friction: Not less than 0.42.
- 8. Finish: Matte, opaque glazed.
- 9. Tile Color and Pattern: As selected by Architect from manufacturer's full range
- 10. Grout Color: As selected by Architect from manufacturer's full range

2.04 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 according to ASTM C1353 or ASTM C241/C241M and with honed finish.
  - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

## 2.05 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
  - 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. Custom Building Products.
    - b. Georgia-Pacific Gypsum LLC.
    - c. USG Corporation.
  - 2. Thickness: 5/8 inch (Align with adjacent moisture resistant gypsum board)

## 2.06 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
  - 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. Laticrete International, Inc.
    - b. MAPEI Corporation.
    - c. Sakrete; CRH Americas, Oldcastle APG.

## 2.07 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. elastomeric polymer and fabric reinforcement.
  - 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. Laticrete International, Inc.
    - b. MAPEI Corporation.
    - c. Sakrete; CRH Americas, Oldcastle APG.

## 2.08 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

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. ARDEX Americas.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
  - d. Sakrete; CRH Americas, Oldcastle APG.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

B. Organic Adhesive: ANSI A136.1, Type I.

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. ARDEX Americas.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.

2.09 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3

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. Laticrete International, Inc.
  - b. MAPEI Corporation.
  - c. Sakrete; CRH Americas, Oldcastle APG.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.010 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; nickel silver exposed-edge material. Provide at all outside corners and at the top of the restroom wainscot. Basis of Design is “Jolly, as manufactured by Schluter 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. Blanke Corporation.
    - b. Ceramic Tool Company, Inc.
    - c. Schluter Systems L.P.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 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. Laticrete International, Inc.
    - b. Sakrete; CRH Americas, Oldcastle APG.
    - c. Southern Grouts & Mortars, Inc.

## 2.011 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.03 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.



- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Glazed Ceramic Tile: 1/16 inch, based on size recommendations.
  - 2. Glazed Wall Tile: 1/16 inch, based on size recommendations.
  - 3. Porcelain Floor Tile: 3/16 inch, based on size recommendations.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  - 1. Do not extend waterproof membrane or crack isolation membrane under thresholds set in standard dry-set, modified dry-set or improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproof membrane or crack isolation membrane with elastomeric sealant.
- K. Metal Edge Strips: Install at top of tile wainscot in restrooms and where exposed edge of tile, corners, inside and outside abut, and flooring meets resinous floor / base or other flooring that finishes flush with or below top of tile and no threshold is indicated
- L. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

#### 3.04 INSTALLATION OF TILE BACKING PANEL

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

### 3.05 INSTALLATION OF WATERPROOF MEMBRANE

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.06 INSTALLATION OF CRACK ISOLATION MEMBRANE

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.07 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.08 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.09 PROTECTION

#### A. Interior Floor Installations, Concrete Substrate / Floor

1. Ceramic Tile Installation: TCNA F125-Full; thinset mortar on crack isolation membrane.
  - a. Ceramic Tile Type
  - b. Crack Isolation Membrane
  - c. Waterproofing
  - d. Thinset Mortar: Latex-Portland Cement mortar.
  - e. Grout: Water-cleanable epoxy grout.

#### B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units.
  - a. Ceramic Tile Type
  - b. Thinset Mortar: Non-Sagging Latex-Portland Cement mortar.
  - c. Grout: Water-cleanable epoxy grout.
  - d. Provide metal edge trim at all outside corners and exposed top of tile wainscott

END OF SECTION

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SECTION 09 51 23

ACOUSTICAL TILE CEILINGS  
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, applicable parts of Division 0- Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings:

***Volume I Drawings Below:***

***General:*** G000, G001, G101, G102, G201, G202, G301

***Structural:*** S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S201, S202, S301, S302, S303, S304, S305, S306, S311, S312, S901

***Architectural:*** A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A112, A113A, A113B, A113C, A114, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A601, A602, A611, A612, A612, A622, A623, A624, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841, A901, A911, A912, A913

***Fire Protection:*** FP000, FP111A, FP111B, FP111C, FP112A, FP112B, FP112C, FP501, FP502

***Plumbing:*** P000, P101A, P101B, P101C, P111A, P111B, P111C, P121A, P121B, P401, P402, P403

***HVAC:*** H001, H101A, H101B, H101C, H102A, H102B, H102C, H103A, H103B, H103C, H200C, H201A, H201B, H201C, H202A, H202B, H202C, H401, H501, H502, H503, H504

***Electrical:*** E001, E111A, E111B, E111C, E112, E211A, E211B, E211C, E501, E502, E503, E504, 505, FA001, FA111A, FA111B, FA111C, FA112, TC001, TC111A, TC111B, TC111C

- D. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.

- E. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION FOR BID AND INSTRUCTIONS TO BIDDERS.

1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER:

SUB-BID FOR TRADE:

ACOUSTICAL TILE

2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Filed Sub-Bid.

#### 1.02 EXAMINATION OF SITE AND DOCUMENTS:

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

#### 1.03 SEQUENCING:

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

#### 1.04 SCAFFOLDS AND STAGING:

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.

1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

1.05      HOISTING MACHINERY AND EQUIPMENT:

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

1.06      DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

1.07      RELATED DOCUMENTS

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

1.08      SUMMARY

- A. Section Includes:
  1. Acoustical tiles for interior ceilings.
  2. Fully concealed, direct-hung, suspension systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.09 PREINSTALLATION MEETINGS

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

#### 1.010 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
  - 2. Concealed Suspension-System Members: 6-inch long Sample of each type.
  - 3. Exposed Moldings and Trim: Set of 6-inch long Samples of each type and color.
  - 4. Seismic Clips: Full size.

#### 1.011 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-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
  - 5. Size and location of initial access modules for acoustical tile.
  - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Access panels.

- g. Perimeter moldings.
- 7. Show operation of hinged and sliding components adjacent to acoustical tiles.
- 8. Minimum Drawing Scale: 1/4 inch = 1 foot
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Field quality-control reports.
- F. Manufacturer to certify that materials provided and installed are asbestos-free, as represented by Manufacturer's Material Safety Data Sheets, on Asbestos-Free Materials Certification Form.

#### 1.012 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.013 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. Acoustical Ceiling Units: Full-size tiles equal to 100 sq ft min for attic stock.
  - 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 10 percent of quantity installed.

#### 1.014 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockup of typical ceiling area as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.



#### 1.015 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

#### 1.016 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Source Limitations:
  - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
  - 2. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

#### 2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E1264.
  - 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

## 2.03 ACOUSTICAL TILES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

- B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

- C. Classification: Provide tiles as follows:

1. Type A1 Ceiling Panel:
  - a. Basis of Design:
    - a) Tiles: USG Halcyon ClimaPlus #97221
    - b) Grid: USG Donn ZXLA Ceiling Grid, ZXLA24, ZXLA424
  - b. Panel Size: 24x 24 by 3/4" thick.
  - c. Panel Edge: Square edge
  - d. ASTM E-1264, Type XII, Form 2, Pattern G. Class A flame spread,
  - e. wet formed mineral fiber fine textured panel, non-combustible, vinyl latex paint finish.
  - f. Color: As selected from manufacturer's full range
  - g. Light Reflectance (LR): Not less than 0.90
  - h. Ceiling Attenuation Class (CAC): Range from 20 min
  - i. Noise Reduction Coefficient (NRC): Range from .90 min
  - j. Edge/Joint Detail: Square
  - k. Thickness: 3/4 inch
  - l. Modular Size: As indicated on Drawings
2. Type A2 Ceiling Panel (locker, toilet and janitor rooms):
  - a. Basis of Design:
    - a) Tiles: USG Radar Ceramic Climaplus, 56644
    - b) Grid: USG DXLA Ceiling Grid Series
  - b. Panel Size: 24x 24 by 5/8" thick.
  - c. Panel Edge: Square edge
  - d. ASTM E-1264, Type X, Pattern G or Type XX, UL Fire Resistance Labeled, wet formed ceramic and mineral fiber composite panel, non-directional perforated impervious panel, non-combustible, white vinyl-plastic coating
  - e. Color: As selected from manufacturer's full range
  - f. Light Reflectance (LR): Not less than 0.82
  - g. Ceiling Attenuation Class (CAC): Range from 38 - 40

- h. Noise Reduction Coefficient (NRC): Range from 0.50 to 0.60.
  - i. Edge/Joint Detail: Square
  - j. Thickness: 5/8 inch  
Modular Size: As indicated on Drawings
- D. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

## 2.04 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Armstrong World Industries, Inc.
  - 2. USG Corporation.
  - 3. Certainteed Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.
- 1. High-Humidity Finish: Provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.
- C. Direct-Hung, Double-Web, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.
- 1. Structural Classification: Intermediate-duty system.
  - 2. Access: Upward and side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
    - a. Initial Access Opening: In each module, 24 by 30 inches

## 2.05 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
  - a. Type: Postinstalled expansion anchors.
  - b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
  - c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

## 2.06 METAL EDGE MOLDINGS AND TRIM:

- 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. Armstrong World Industries, Inc.
  - 2. CertainTeed Corporation.
  - 3. USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
  - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
  - 2. Finish: Painted to match color of acoustical unit
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
  - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
  - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.07 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## 2.08 MISCELLANEOUS MATERIALS

- A. Acoustical Tile Adhesive: Type recommended in writing by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.
- B. Staples: 5/16-inch- long, divergent-point staples.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- C. Layout openings for penetrations centered on the penetrating items.

### 3.03 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Install suspended acoustical tile ceilings according to ASTM C636/C636M, and manufacturer's written instructions.
  - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
  2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
  3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

### 3.04 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Directly Attached Ceilings: Install bottom surface of tiles to a tolerance of 1/8 inch in 12 feet and not exceeding 1/4 inch cumulatively.
- C. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

### 3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
  - 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
  - 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical tile ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.06 ADJUSTING



- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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## SECTION 09 65 13

### RESILIENT BASE AND ACCESSORIES (FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 01)

#### 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. Thermoset-rubber base.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

##### 1.04 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

##### 1.05 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### 1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
  1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

### PART 2 - PRODUCTS

#### 2.01 THERMOSET-RUBBER BASE

- 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. Flexco.
  2. Johnsonite; a Tarkett company.
  3. Roppe Corporation.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  1. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient floor coverings.
    - c. Style C, Butt to: Provide in areas indicated.

- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: Match Architect's sample. As chosen from Manufacturer's full range by Architect.

## 2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.03 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### 3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  1. Remove adhesive and other blemishes from surfaces.
  2. Sweep and vacuum horizontal surfaces thoroughly.
  3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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SECTION 09 65 19  
RESILIENT TILE FLOORING  
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 01)

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. Solid luxury vinyl floor tile (Planks)

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
  - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Samples for Initial Selection: For each type of floor tile indicated.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

#### 1.06 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.
    - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

#### 1.09 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.



- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 2.02 SOLID VINYL FLOOR TILE (PLANKS)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Basis of Design shown in drawings is *"Hot & Heavy Collection, Secoya"* as manufactured by Mohawk Group.

- a. Mohawk Group
- b. Armstrong
- c. Shaw

- B. Tile Standard: ASTM F1700

- 1. Class: I
- 2. Type: A, Smooth Surface

- C. Thickness: 5 mm

- D. Size: 9 by 59 inches

- E. Installation Method: Adhesive Installation

- F. Colors: As selected by Architect from manufacturer's full range

- G. Patterns: As shown on drawings, Brick Ashlar per Manufacturer cut sheet for the basis of design.

### 2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

- C. Seamless-Installation Accessories:
  - 1. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.03 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles in pattern of colors and sizes indicated
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Apply two coat(s).
- E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- F. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

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## SECTION 09 65 66

### RESILIENT ATHLETIC FLOORING (FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 01)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:

- 1. Interlocking, rubber floor tile.

- B. Related Requirements:

- 1. Section 09 65 13 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

##### 1.3 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show installation details and locations of the following:

- 1. Seam locations for sheet flooring.

- C. Samples: For each exposed product and for each type, color, and pattern specified, 6-inch square in size and of the same thickness indicated for the Work.

- 1. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

- D. Samples for Initial Selection: For each type of resilient athletic flooring.

- 1. Game-Line and Marker Paint: Include charts showing available colors and glosses.

- E. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch square in size and of same thickness and material indicated for the Work.
  - 1. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For sheet vinyl flooring Installer.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

#### 1.7 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. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

#### 1.8 QUALITY ASSURANCE

- A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration.
  - 1. Store tiles on flat surfaces.
  - 2. Store rolls upright.

#### 1.10 FIELD CONDITIONS

- A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
  2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
  3. Close spaces to traffic during flooring installation.
  4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 INTERLOCKING, RUBBER FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Johnsonite; a Tarkett company.
  2. Mondo.
  3. Roppe Corporation; Roppe Holding Company.
- B. Description: Athletic flooring consisting of modular rubber tiles with precision cut, interlocking edges, for free-lay installation.
- C. Material: Recycled-rubber compound
- D. Tile Interlock: Hidden
- E. Traffic-Surface Texture: Smooth
- F. Size: Manufacturer's standard-size square tile
- G. Thickness: 3/8 inch minimum
- H. Weight: Not less than 11 lbs per square foot.
- I. Color and Pattern: As selected by Architect from manufacturer's full range

### 2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5
  - 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
  - 1. Do not install flooring until it is the same temperature as space where it is to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

### 3.4 FLOOR TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis
- B. Discard broken, cracked, chipped, or deformed tiles.
- C. Free-Lay Tile: Place flooring at locations indicated with units securely interconnected and fully seated on substrate to form a smooth, level surface.

### 3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing flooring installation:
  - 1. Remove adhesive and other blemishes from flooring surfaces.
  - 2. Sweep and vacuum flooring thoroughly.
  - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
  - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 09 67 23  
RESINOUS FLOORING

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. Resinous flooring systems.

- B. Related Sections:

- 1. Section 03 30 00 – Cast-In-Place Concrete for concrete slab on grade conditions
  - 2. Section 03 05 10 – Concrete Moisture Vapor Reduction Admixture for moisture requirements of resinous floor on top of cast-in-place concrete slab.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required.
- C. Samples for Verification: For each resinous flooring system required, 12 inches square, applied to a rigid backing by Installer for this Project.

1.05 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

- B. Material Certificates: For each resinous flooring component, from manufacturer.
- C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.
    - a. Include 96-inch length of integral cove base with inside and outside corner.
  - 2. Simulate finished lighting conditions for Architect's review of mockups.
  - 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.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

#### 1.09 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing according to ASTM D635.

### 2.02 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

### 2.03 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Duraflex, Inc.
    - b. Sherwin-Williams Company, General Polymers.
    - c. Tnemec Inc.
- B. System Characteristics:
  - 1. Color and Pattern: As selected by Architect from manufacturer's full range
  - 2. Wearing Surface: Textured for slip resistance
  - 3. Overall System Thickness: 1/4 inch
- C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- D. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
  - 1. Formulation Description: 100 percent solids

- a. Provide fiberglass scrim embedded in reinforcing membrane.
- E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- F. Body Coats:
  - 1. Resin: Urethane
  - 2. Formulation Description: 100 percent solids
  - 3. Type: Pigmented
  - 4. Application Method: Troweled or screeded
  - 5. Number of Coats: Two
  - 6. Thickness of Coats: 1/16 inch
  - 7. Aggregates: Manufacturer's standard
- G. Grout Coat:
  - 1. Resin: Urethane
  - 2. Formulation Description: 100 percent solids
  - 3. Type: Pigmented
  - 4. Thickness of Coat: 1/16 inch
- H. Topcoats: Sealing or finish coats.
  - 1. Resin: Epoxy novolac
  - 2. Formulation Description: Water based
  - 3. Type: Clear
  - 4. Number of Coats: Two
  - 5. Thickness of Coats: 1/16 inch
  - 6. Finish: Matte
- I. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
  - 1. Compressive Strength: 5,000 psi minimum according to ASTM C579.
  - 2. Tensile Strength: 1,000 minimum according to ASTM C307.
  - 3. Flexural Modulus of Elasticity:  $1.1 \times 10^6$  psi minimum according to ASTM C580.
  - 4. Water Absorption: < 1% percent maximum according to ASTM C413.
  - 5. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
  - 6. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch according to MIL-D-3134J.
  - 7. Hardness: 80-84, Shore D according to ASTM D2240.
  - 8. Critical Radiant Flux: 0.45 W/sq. cm or greater according to NFPA 253.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Roughen concrete substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with NACE No. 6/SSPC-SP13, with a Concrete Surface Profile (CSP) of 3 or greater in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
  - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
  - 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 4.5 lb of water/1000 sq. ft of slab area in 24 hours.
    - b. Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
  - 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
  - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

### 3.02 INSTALLATION

- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Reinforcing Membrane: Apply reinforcing membrane to entire substrate surface.
- D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
  - 1. Integral Cove Base: 4 inches high.
- E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.
  - 1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
- G. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
- H. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

### 3.03 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
  - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
  - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
  - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

### 3.04 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

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## SECTION 09 68 13

### TILE CARPETING

#### 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. Modular carpet tile (CPT)

- B. Related Requirements:

- 1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

##### 1.03 PREINSTALLATION MEETINGS

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

- 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
    - a. Review delivery, storage, and handling procedures.
    - b. Review ambient conditions and ventilation procedures.
    - c. Review subfloor preparation procedures.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include manufacturer's written installation recommendations for each type of substrate.

- B. Sustainable Design Submittals:

- C. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

E. Samples for Initial Selection: For each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

F. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

G. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

H. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

#### 1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### 1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

#### 1.08 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Build mockups at locations and in sizes shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

#### 1.010 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

#### 1.011 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.

- b. Dimensional instability.
- c. Excess static discharge.
- d. Loss of tuft-bind strength.
- e. Loss of face fiber.
- f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 CARPET TILE (CPT)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, (basis of design is “*Savant as manufactured by Tarkett*”):
  - 1. Mohawk Carpet, LLC; The Mohawk Group.
  - 2. Shaw Industries Group, Inc.; Berkshire Hathaway Company.
  - 3. Tandus; a Tarkett company.
- B. Color: As selected by Architect from manufacturer's full range
- C. Fiber Type: Dynex SD Nylon (Stain Resist)
- D. Pile Characteristic: Stratatec Patterned Symtex
- E. Face weight: 28 oz / sq yard
- F. Pile Height: 0.187 inch
- G. Stitches: 10 / inch
- H. Gage: 5/64 inch
- I. Primary Backing/Backcoating: Non-woven synthetic
- J. Secondary Backing: Ethos
- K. Stain Protection: Ethos
- L. Size: 24 by 24 inches
- M. Applied Treatments:
  - 1. Soil-Resistance Treatment: Manufacturer's standard treatment
  - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

- a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

N. Performance Characteristics:

- a) Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
- b) Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
- c) Dimensional Stability: 0.10 percent or less per ISO 2551 (Aachen Test).
- d) Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
- e) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
- f) Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
- g) CRI Indoor Air Quality Control Green Label Plus certified.

2.02 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.

- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Wood Subfloors: Verify the following:
1. Underlayment over subfloor complies with requirements specified in Section 06 16 00 "Sheathing."
  2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Metal Subfloors: Verify the following:
1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- F. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.
1. Access Flooring Systems: Verify the following:
  2. Access floor substrate is compatible with carpet tile and adhesive if any.
  3. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.03 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

### 3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 09 77 23  
PLASTIC WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish and install the following:
  - 1. Decorative wall panels consisting of corrugated polypropylene substrate with smooth finish.
  - 2. Mounting hardware, adhesives, furring, accessories and trims.
  - 3. Silicone sealant for all joints between panels and moldings, and between panel system and abutting materials.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 — UNIT MASONRY: Masonry substrate:
- B. Section 09 29 00 — GYPSUM BOARD: Gypsum drywall substrate.
- C. Division 26 - ELECTRICAL: Recessed electrical receptacles.

1.03 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
  - 3. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
  - 4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 5. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
  - 6. All applicable federal, state and municipal codes, laws and regulations regarding wall finishes and smoke generation.

#### 1.04 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
  - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
  - 2. Certification: Manufacturer's written certification stating that panel system and all related components to be furnished hereunder, meet or exceed the requirements specified under this Section that all fire-resistive requirements for the indicated requirements have been met.
  - 3. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions
  - 4. Verification samples:
    - a. Manufacturer's samples of wall panels, including tongue and groove edges and nailing fins.

#### 1.05 QUALITY ASSURANCE

- A. Installer qualifications: Installer shall have a minimum of 5 years experience with composite wall panel work similar in scope and size to this project.

#### 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. Handling: Protect materials during handling and installation to prevent damage.
- C. Storage:
  - 1. Store materials in clean, dry area indoors.
  - 2. Store wall panels flat.

#### 1.07 ENVIRONMENTAL CONDITIONS

- A. Installing wall panels:
  - 1. Cold Temperatures: When installing wall panels in temperatures below 40 degrees F, warm to a minimum of 60 degrees F overnight and leave space between panels to allow for expansion in accordance with manufacturer's instructions.
  - 2. Warm Temperatures: When installing wall panels in temperatures above 70 degrees F, warm panels to a minimum of 60 degrees F in accordance with manufacturer's instructions.
- B. Cutting panels: Before field cutting wall panels in temperatures below 40 degrees F, warm panels to a minimum of 60 degrees F overnight.

## 1.08 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels:
  - 1. Wall Panels: Furnish quantity of full size units equal to 3 percent of the amount installed.

## 1.09 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 —PROJECT CLOSEOUT.
- B. Manufacturer Warranty:
  - 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
  - 2. Warranty Period for Wall Panels: 2 years.

## PART 2 -PRODUCTS

### 2.01 MANUFACTURERS

- A. Specified Manufacturer for decorative panels: To establish a standard of quality, design and function desired, specifications have been based on Nudo, Springfield, IL, product: "UtiLite Wall Panel".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
  - 1. Nudo, Springfield, IL.
  - 2. Extrutech Plastics, Inc., Manitowoc, WI.
  - 3. Parkland Plastics, Middlebury, IN.
- C. Materials:
  - 1. Panels: Tongue and groove, rib reinforced, non-porous, waterproof, 100percent virgin polyvinyl chloride panels with a smooth finish.
  - 2. Outside surface: Flat.
  - 3. Thickness: 0.040 inch.
  - 4. Width: 16 inches.

5. USDA and CFIA acceptance.
6. Color: White, glossy finish.
7. Size: As indicated on the Drawings.
8. Surface Burning Characteristics, Class A per ASTM E84.
9. Trim: 100 percent virgin polyvinyl chloride in color to match panels.

## 2.02 ACCESSORIES

- A. Blocking: Provide solid 5/4 inch thick PVC blocking for wall-mounted equipment.
- B. 1/2 inch PVC furring.
- C. Sealant: One part acetoxysilicone rubber sealant, USDA approved as recommended by panel manufacturer.
- D. Fasteners as recommended by manufacturer.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Notify the Engineer of conditions that would adversely affect installation or subsequent use.
- B. Do not begin preparation or installation until unacceptable conditions are corrected.

### 3.02 PREPARATION

- A. Ensure walls are dry and clean.

### 3.03 INSTALLATION

- A. Prior to installing panels, remove packaging and allow panels to acclimate to room temperature and humidity for at least 48 hours.
  1. Wall substrate must be dry and free from dirt, dust, grease and other contaminants. Walls must be flat and even. Remove high spots and fill low spots with material acceptable to panel manufacturer.
  2. Painted walls must be prepared to adhesive manufacturer specifications for proper adhesion.
- B. General:
  1. Inspect panels for any defects. Do not install panels of unacceptable quality.
  2. Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.

- a. Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protective will until after installation.
- C. For installation to studs or furring straps, use mechanical fasteners spaced 24 inches on center. Furring straps shall be no less than 18 gauge, 3-1/2 inches wide.
  1. Install panels using the following method.
    - a. Aluminum moldings.
- D. Installation Using Aluminum Moldings:
  1. Start in the corner. Mark plumb line 48 1/8 inches from corner.
  2. Apply adhesive directly to entire back of composite wall panel using correct trowel with 100% adhesive coverage using crosshatch pattern. Apply adhesive to within 1/2 inch of all edges of panel.
  3. Slide panel into molding and withdraw 1/16 inch for aluminum moldings to provide appropriate gap. Align with plumb line.
  4. Begin in top corner nearest molding with laminate roller, rolling down and out toward the edge without molding.
  5. Continue rolling down and out working across panel away from previously installed panel or initial molding. Remove all trapped air.
  6. Install one-piece division bar and caps or next molding by sliding onto panel.
  7. Repeat process, working in one direction around room.
  8. Immediately remove all adhesive residue. To remove, clean with nonabrasive cotton cloth and warm water. If necessary, use a mild nonabrasive detergent. For cleanup with solvent based adhesives, use mineral spirits or acetone to remove residue.

### 3.04 CLEANING

- A. Clean panel surfaces in compliance with manufacturer's recommendations.
  1. Use a clean, damp, nonabrasive cotton cloth and a mild liquid detergent or household cleaner.
  2. Rinse with clean water using a clean, nonabrasive cotton cloth.
  3. Dry panels with a soft, clean nonabrasive cotton cloth.
  4. Do not use cleaners containing acid, alkali or sodium hypochlorite.
- B. Daily clean work areas by sweeping and disposing of debris and scraps.
- C. Completely clean all panel surfaces, clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealants and adhesives with solvents which will not damage the surfaces in any way.

- D. Upon completion of the work of this Section, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

### 3.05 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

END OF SECTION

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SECTION 09 90 00

PAINTING  
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, applicable parts of Division 0- Procurement and Contracting Requirements, and Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the filed sub-bid "Painting" include all of the following listed Specification Sections: in their entirety:

**1. Section 09 90 00 – PAINTING**

**2. Section 09 90 01 – PAINTING – SALT SHED**

- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings:

***Volume I Drawings, Below:***

***General: G000, G001, G101, G102, G201, G202, G301***

***Civil: C001, C200, C201, C202, C300, C301, C302, C401, C502,***

***Structural: S001, S002, S003, S100, S101A, S101B, S101C, S110, S111A, S111B, S111C, S121, S130, S131, S131B, S131C, S140, S201, S202, S301, S302, S303, S304, S305, S306, S311, S312, S901, S902***

***Architectural: A011, A021, A031, A101, A102, A103, A104, A105, A106, A107, A111A, A111B, A111C, A112, A113A, A113B, A113C, A114, A115A, A115B, A115C, A116, A201, A211, A212, A213, A221, A231, A232, A301, A302, A401, A402, A403, A404, A411, A412, A501, A502, A503, A511, A512, A601, A602, A611, A612, A621, A622, A623, A624, A631, A701, A702, A703, A801, A811, A821, A831, A832, A841, A851, A901, A911, A912, A913***

***Wood Salt Shed: A1001, A1002, A1003, A1004, A1005, A1006, A1007, A1008***

**Industrial Equipment:** EQ101, EQ201, EQ103, EQ104

**Fire Protection:** FP000, FP111A, FP111B, FP111C, FP112A, FP112B, FP112C, FP 501, FP 502

**Plumbing:** P000, P101A, P101B, P101C, P111A, P111B, P111C, P121A, P121B, P401, P402, P403, P404

**HVAC:** H001, H101A, H101B, H101C, H102A, H102B, H102C, H200C, H201A, H201B, H201C, H202A, H202B, H202C, H401

**Electrical:** E001, E002, E111A, E11B, E111C, E112, E211A, E211B, E211C, E212, FA001, FA111A, FA111B, FA111C, FA112, TC001, TC111A, TC111B, TC111C

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION FOR BID AND INSTRUCTIONS TO BIDDERS.
  - 1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER: \_\_\_\_\_

SUB-BID FOR TRADE: PAINTING

- 2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Filed Sub-Bid.

G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

## 1.02 EXAMINATION OF SITE AND DOCUMENTS:

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.



- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.03 SEQUENCING:

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Engineer.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Engineer in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.04 SCAFFOLDS AND STAGING:

- A. General: Filed Sub-contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 52 13 - TEMPORARY FACILITIES and herein.
  - 1. Scaffolding and staging required for use by this Filed Sub-contractor pursuant to requirements of Section 01 52 13 - TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
  - 2. Each Filed Sub-contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 52 13 - TEMPORARY FACILITIES and as additionally required for dust control).
  - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Sub-contractor.
  - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

1.05 HOISTING MACHINERY AND EQUIPMENT:

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 52 13 - TEMPORARY FACILITIES.

1.06 DAILY CLEANUP:

- A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

1.07 WORK INCLUDED:

- A. This Section covers field painting and coating of surfaces, complete. Shop painting of metal items is specified under the applicable item.
- B. A schedule listing the various types of surfaces to be painted and the types of paints to be applied is included herein.
- C. Unless otherwise indicated, the following items shall not be painted:
  - 1. Labels on equipment, such as Underwriters' Laboratories and Factory Mutual, equipment identification, performance rating, and name or nomenclature plates.
  - 2. Moving parts of operating units, exposed bolt threads, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.
  - 3. Electrical conduit unless mounted on painted or finished surfaces or exposed in a finished room.
  - 5. Stainless steel
  - 6. Concrete floor slabs
  - 7. Plumbing fixtures.
  - 8. Fiberglass and polyethylene storage tanks.
  - 9. Uninsulated PVC piping (to be banded only)
  - \* 10. Factory prefinished architectural components.
  - \* 11. Electrical panels and cabinets factory finish painted.

12. Pre-Engineered Metal Building Steel frames, secondary and primary.

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\* Except for touch-up painting when required

1.08 Related Requirements:

- A. Section 04 20 00, UNIT MASONRY
- B. Section 05 50 00, METAL FABRICATIONS
- C. Section 05 51 13, METAL PAN STAIRS
- D. Section 05 52 13, PIPE AND TUBE RAILINGS
- E. Section 06 10 00, ROUGH CARPENTRY
- F. Section 06 20 13, EXTERIOR FINISH CARPENTRY
- G. Section 08 17 43, AF COMPOSITE DOORS
- H. Section 08 31 13, ACCESS DOORS AND FRAMES
- I. Section 09 29 00, GYPSUM BOARD
- J. Section 13 42 00, PRE-ENGINEERED METAL BUILDING
- K. DIVISION 21, 22, 23, 26

1.09 SYSTEM DESCRIPTION:

- A. The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as prime, intermediate, or finish coats.
- B. The Contractor shall do a complete painting job throughout the work in accordance with generally approved modern practices for work of high quality. Unless otherwise specified, all materials and surfaces customarily painted shall be given not less than one shop coat and two field coats or one prime coat and two finish coats, regardless of whether or not the surface to be painted is specifically mentioned.
- C. Paints containing lead shall not be used.
- D. To ensure a satisfactory painting job it is essential that the paints applied in the shop and in the field be mutually compatible. The Contractor shall determine what shop paints have been used and shall verify that field applied paints are compatible therewith.

- E. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.
- F. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (N.S.F.) in accordance with Standard 61. Evidence of such approval shall be an approval letter from N.S.F. listing the submitted materials.
- G. Paints submitted shall meet all Federal and State E.P.A. regulations pertaining to volatile organic compounds (VOC) compliance.

1.10 REFERENCES:

- A. The following standards form a part of these specifications, and indicate the minimum standards required:

American Society for Testing and Materials (ASTM)

ASTM      F1869      Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride

1.11 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL CONDITIONS, SUBMIT THE FOLLOWING:

- A. Provide manufacturer's literature of proposed paints shall be submitted to the Engineer for review.
- B. The painting schedule shall be submitted to the Engineer for review.
- C. Three (3) sets of color chips shall be submitted to the Engineer for selection of colors.

1.12 DELIVERY AND STORAGE:

- A. Paint shall be delivered to the site in the manufacturer's sealed containers. Each container shall bear the manufacturer's label, listing the brand name, type and color of paint, and instructions for thinning. Thinning shall be done only in accordance with directions of the manufacturer. Job mixing or job tinting may be done when approved by the Engineer and for preparing sample colors.

- B. Painting materials shall be stored and mixed in a single location designated by the Engineer for this purpose. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. He shall carry all necessary water to his mixing room and shall dispose of all waste outside of the building in a suitable receptacle. The Contractor will be held responsible for any damage done due to failure to observe these precautions.
- C. The paint storage area shall be kept clean at all times, and any damage thereto or to its surroundings shall be repaired. Any oily rags, waste, etc., shall be removed from the building every night, and every precaution shall be taken to avoid danger of fire.
- D. Heat must be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F. at all times.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

#### A. PAINT SCHEDULE:

Except as otherwise indicated, all paint used shall be of the type listed in the schedule below, by Tnemec Company, Inc., or equivalent paints by Sherwin-Williams Company, International Paints, or other approved paint fully equal to paint manufactured by the above-named companies. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following painting schedule are submitted in writing to the Engineer, along with sufficient data supported by certified tests.

## PAINT SCHEDULE

| <u>Key</u> |                                          | <u>Tnemec</u>                                  | <u>Note 1</u>   |
|------------|------------------------------------------|------------------------------------------------|-----------------|
| AGE        | Acryli Gloss Enamel                      | 1029 Enduratone                                | 3.5             |
| APE        | Acrylic Polyurethane                     | 73 Endura-Shield Enamel                        | 3.0             |
| ALP        | Acrylic Latex Primer                     | A100 Exterior Latex Wood Primer                | 3.0             |
| ALHP       | Acrylic Latex Satin House & Trim Paint   | A100 Exterior Latex Satin House and Trim Paint | 4.0             |
| ABF        | Cementitious Block Filler                | 130 Envirofill                                 | 80-100 s.f./gal |
| CEE        | Catalyzed Epoxy                          | L69F Epoxoline II                              | 4.0             |
| CEM        | Catalyzed Epoxy Mastic                   | 27 WB Typoxy                                   | Note 3          |
| CEP        | Catalyzed Epoxy Primer                   | L69F Epoxoline                                 | 3.0             |
| EMC        | Epoxy Modified Cement                    | 218 Mortar-Clad                                | Fill/Surface    |
| EP         | Epoxy-Polyamide (thinned 30% #4 thinner) | FC 22 Pota-pox                                 | 25-30           |
| EPW        | Water-based Epoxy Primer                 | 151 Elasto-Grip                                | 1.0-1.5         |
| HGV        | High Gloss Varnish                       |                                                | Note 2          |
| HSE        | High Solids Epoxy (Minimum 69%)          | L69 Epoxy                                      | 6.0             |
| MA         | Modified Acrylic                         | 115 Uni-bond                                   | 3.0             |
| MAE        | Modified Acrylic Elastomer               | 156 Envirocrete                                | 6.0-8.0         |
| MCU        | Moisture Cured Urethane                  | Series 1 - Omnithane                           | 2.5-3.0         |
| MPE        | Modified Polyamine Epoxy                 | Series 435 - Permaglaze                        | 15-20 mils      |
| NE         | Novolac Epoxy                            | 282 Tneme-Glaze                                | 7.5             |
| PEF        | Polyamine Epoxy Finish                   | 280 Tneme-Glaze                                | 6.0-8.0         |
| PEP        | Polyamine Epoxy Primer                   | 201 Epoxoprime                                 | 6.0-8.0         |
| PVA        | PVA Sealer                               | 151 Elasto Grip                                | 0.75-1.5        |
| PWC        | Potable Water Coating                    | Series FC 22 Pota Pox                          | 25-30           |

### PAINT SCHEDULE

| <u>Key</u> |                                                                                                                                                                                                                                                                                                                                                                                       | <u>Tnemec</u>       | <u>Note 1</u> |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------|
| SA         | Silicone Aluminum                                                                                                                                                                                                                                                                                                                                                                     | 39-1261 (Note 4)    | 1.5           |
| VB         | Vapor Barrier                                                                                                                                                                                                                                                                                                                                                                         | 262 Elasto Shield   | 50-100        |
| WP         | Wood Primer                                                                                                                                                                                                                                                                                                                                                                           | 151 Elasto-Grip     | 1.0-1.5       |
| Z          | Zinc-Rich Primer                                                                                                                                                                                                                                                                                                                                                                      | 90G-1K97 Tneme-Zinc | 2.5           |
| Notes      | <ul style="list-style-type: none"><li>1: Minimum Dry Film Thickness/Coat (mils)</li><li>2: Furnished by reputable manufacturer and acceptable to the Engineer.</li><li>3: Shall be used as a tie-coat between incompatible paints @ 3.0-4.0 mils.</li><li>4: This paint is suitable for temperatures up to 1200°F and must be final cured at 400°F for one hour.</li><li>5:</li></ul> |                     |               |

#### B. PAINTING SCHEDULE:

Paint shall be applied in accordance with the paint key listed on the following schedule and defined in the preceding Paint Schedule:

| <u>Item</u>                                                                                                                                                              | <u>Field Coats</u>               |      |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------|-----------------|
|                                                                                                                                                                          | 1st                              | 2nd  | 3 <sup>rd</sup> |
| <u>Walls:</u>                                                                                                                                                            |                                  |      |                 |
| Interior concrete masonry units                                                                                                                                          | ABF                              | HSE  | HSE             |
| Interior concrete designated to be painted, to include top and outside of all concrete curbs                                                                             | HSE                              | HSE  | --              |
| Plaster & gypsum wallboard                                                                                                                                               | PVA                              | HSE  | HSE             |
| <u>Floors:</u>                                                                                                                                                           |                                  |      |                 |
| Concrete floors designated to be painted                                                                                                                                 | PEP                              | PEF  | PEF             |
| <u>Ceilings and Walls:</u>                                                                                                                                               |                                  |      |                 |
| Exposed galvanized metal deck/bar joists, dry spaces^                                                                                                                    | MA                               | --   | --              |
| Plaster & gypsum wallboard                                                                                                                                               | PVA                              | CEE  | CEE             |
| <u>Equipment Items:</u>                                                                                                                                                  |                                  |      |                 |
| With shop prime coat, including machinery and pumps (non-submerged)<br>(submerged)                                                                                       | Interior                         | *CEP | CEE             |
|                                                                                                                                                                          | Exterior                         | *CEP | APE             |
|                                                                                                                                                                          | Exterior                         | MPE  | MPE             |
| With shop finish coat (when designated to be painted)                                                                                                                    | Interior                         | *CEM | CEE             |
|                                                                                                                                                                          | Exterior                         | *CEM | APE             |
| <u>Metals:</u>                                                                                                                                                           |                                  |      |                 |
| Exposed interior structural steel including monorails and supports                                                                                                       | *Z                               | CEE  | CEE             |
| Exposed exterior structural steel including monorails and supports                                                                                                       | *Z                               | CEE  | APE             |
| Interior miscellaneous galvanized and non-ferrous metals and piping                                                                                                      | CEE                              | CEE  | --              |
| Exterior miscellaneous galvanized and non ferrous metals and piping (SP7 required)                                                                                       | CEE                              | APE  | --              |
| Miscellaneous interior ferrous piping, metalwork, ferrous parts or operating devices, valve handles, levers, pumps, and ferrous hangers and supports (exterior exposure) | CEP                              | CEE  | --              |
|                                                                                                                                                                          | CEP                              | CEE  | APE             |
| Exposed electrical conduit, conduit fittings, outlet boxes                                                                                                               | Same as adjacent wall or ceiling |      |                 |
| Hot ferrous metal surface                                                                                                                                                | SA                               | SA   | --              |
| <u>Exterior Carpentry Items:</u>                                                                                                                                         |                                  |      |                 |



|                                                      |     |      |      |
|------------------------------------------------------|-----|------|------|
| Exterior Cellular PVC Trim                           | ALP | ALHP | ALHP |
| Mineral Fiber Cement Siding / Shakes (Touch-up only) | ALP | ALHP | ALHP |

Doors and Frames:

|                                                |     |     |    |
|------------------------------------------------|-----|-----|----|
| Interior hollow metal doors, frames and panels | AGE | AGE | -- |
| Exterior hollow metal doors                    | AGE | AGE | -- |

Piping:

|                                                                                             |     |     |     |
|---------------------------------------------------------------------------------------------|-----|-----|-----|
| PVC Piping designated to be painted (SP7 or hand sand)                                      | CEE | CEE | --  |
| Pipe insulation (plastic or metal sheathed paint as scheduled for plastic or metal surface) | PVA | CEE | CEE |
| Other piping (see metals)                                                                   |     |     |     |

\* Spot Prime

\*\*\*For existing, painted masonry walls, use EPW primer, followed by two coats of MAE.

^ If galvanized metal is provided with a light top coat sealer, light brush blast surface preparation is required prior to first field coat

B. SPARE PAINT:

1. Furnish to the Owner one unopened gallon of each type and color of paint used on the work.
2. Furnish both components for each type and color of epoxy paints used on the work.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

- A. Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint, efflorescence, etc. All necessary special preparatory treatment shall then be applied. Where required, imperfections and holes in surfaces to be painted shall be filled in an approved manner.
- B. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting, shall be painted with the first field coat as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surface.

- D. Wood shall be sanded to a smooth and even surface and then dusted off. Before priming wood that is to be painted, shellac shall be applied to all knots, pitch and sapwood. After priming or stain coat has been applied, nail holes and cracks shall be thoroughly filled with plastic wood or putty. For natural finish work, putty shall be colored to be imperceptible in the finished work.
- E. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paint shall be spot primed with aluminum.
- F. Cracks and holes in masonry and concrete surfaces to be painted shall be filled with patching material recommended by the coatings manufacturer. Surfaces shall be clean and dry before painting. All efflorescence, grease, oil, etc., shall be removed before painting, and all loose, crumbling material shall be removed by vigorous wire brushing over entire surface, followed by removal of all dust. All high areas on masonry and concrete surfaces such as mortar daubs, mortar ridges at joints, and ridges at form joints in concrete shall be removed.
- G. All holes in plaster shall be filled with plaster of paris and all cracks shall be cut out and filled. No sandpaper shall be used on plastered surfaces. Prior to painting, surfaces shall be tested with a moisture detecting device, such as Kaydel Plaster Tester, Type CP-48, as manufactured by Hard Moisture Gauges, Inc. No sealer or paint shall be applied when the moisture content of the plaster exceeds 8 percent, as determined by the test. Testing shall be done in the presence of the Engineer's representative, and in as many locations as directed. Plaster shall be thoroughly dry-brushed before painting or sealing.
- H. All nonferrous metal surfaces to be painted shall be cleaned of all dirt, grease, oil and other foreign substances uniformly profiled per SSPC SP 7.
- I. All galvanized surfaces to be painted shall be brush blasted to create a uniform surface profile per SSPC SP7.
- J. Before application of the first full field coat, abraded areas of all non-galvanized ferrous metal items having shop coats shall be touched up with paint of the type indicated on the Painting Schedule.
- K. All items of equipment such as motors, pumps, instrumentation panels, electrical switchgear, and similar items, that have been given shop coats, paint filler, enamel or other treatment customary with the manufacturer, shall have, after installation, all scratches and blemishes touch up prior to application of the first field coat. Factory prefinished items not to be field painted shall be touched up with matching paint to repair any areas damaged during installation.

- L. All submerged concrete surfaces that are to receive an epoxy coating shall be brush blasted to remove surface laitance and provide a uniform surface profile, reference SSPC SP #13. Surface preparation may commence one week after the concrete has been pronounced cured. The curing period is defined as that length of time during which the concrete is fully hydrated (28-day cure). Patch holes and voids with specified modified epoxy cement prior to coating.
- M. Concrete floors that are to receive epoxy coating shall be brush blasted or shot blasted per SSPC SP #13 and ICRI Surface Profile requirements per the coating manufacturer (Blastrack). Check for excessive moisture migration per ASTM F1869, Moisture Vapor Emission Rate Using Anhydrous Calcium Chloride. Test results not to exceed 3 lbs per 1,000 square feet in one 24-hour period.
- N. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be removed during painting operations and repositioned upon completion of each area or shall otherwise be protected.
- O. All PVC pipe to be painted shall be brush blasted per SSPC SP7 or shall be sanded to provide a uniform surface profile.

### 3.02 APPLICATION:

- A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified, and with particular attention to the correct preparation and condition of surfaces to be painted.
- B. Paint shall be applied only within the temperature range recommended by the manufacturer. Painting of surfaces when they are exposed to the sun shall be avoided.
- C. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog, or mist, or when the relative humidity exceeds 85 percent.
- D. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40°F within 18 hours after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. Further, the days painting should be completed well in advance of the probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.

- E. All paint shall be applied under favorable conditions by skilled painters and shall be brushed out carefully to a smooth, even coating without run or sags. Enamel shall be applied evenly and smoothly. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but also throughout the thickness of the paint film before the next coat is applied. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.
- F. Exposed nails and other ferrous metal or surfaces to be painted with water-thinned paints shall be spot primed with aluminum paints.
- G. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.
- H. The Contractor shall not only protect his work at all times but shall also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of his work. Upon completion of the work, he shall clean up all paint, spots, oil, and stains from floors, glass, hardware, and similar finished items.
- I. Paint shall be applied so as to obtain coverage per gallon and the dry film thickness recommended by the manufacturer. Dry film thickness readings shall be taken to insure that required thicknesses have been achieved. The Contractor shall record in a manner satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.
- J. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.
- K. If paints are thinned for spraying, the film thickness after application shall be the same as though the unthinned paint were applied by brush. That is, the addition of a thinner shall not be used as a means of extending the coverage of the paint, but the area covered shall be no greater than the area that would have been covered with the same quantity of unthinned paint.
- L. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.
- M. The use of carbon dioxide or carbon monoxide emitting heaters is not permitted during the painting operation. Only indirect hot-air systems shall be permitted.

### 3.03 PIPING COLOR CODE:

The following Tnemec colors shall be utilized to facilitate identification of piping. Only insulation is to be painted on chemical feed lines.

1. Water Lines

|                     |           |      |
|---------------------|-----------|------|
| Finished or Potable | Dark Blue | 11SF |
|---------------------|-----------|------|

2. Wastewater or Potable Waste Lines

|                           |           |      |
|---------------------------|-----------|------|
| Sewer (sanitary or drain) | Dark Gray | 34GR |
|---------------------------|-----------|------|

3. Other

|                |            |      |
|----------------|------------|------|
| Compressed Air | Dark Green | 91GN |
| Gas or Oil     | Red        | 28RD |
| Other Lines    | Light Gray | 32GR |

B. In situations where two colors do not have sufficient contrast to easily differentiate between them, a 6-inch band of contrasting color shall be painted on one of the pipes at approximately 30-inch intervals.

C. Piping which is not painted shall be color coded with bands placed at each change in direction and no more than 5 feet apart on straight runs.

3.04 PIPING IDENTIFICATION:

A. After painting, piping shall be identified by stenciling using the same specified paint as used on the pipes. Stenciling shall be of wording and color selected by the Engineer and sized as follows:

| <u>Outside Diameter of Pipe or Covering</u> | <u>Size of Legend Letters</u> |
|---------------------------------------------|-------------------------------|
| 3/4-inch to 1-1/4-inch                      | 2-inch                        |
| 1-1/2-inch to 2-inch                        | 3/4-inch                      |
| 2-1/2-inch to 6-inch                        | 1-1/4-inch                    |
| 8-inch to 10-inch                           | 2-1/2-inch                    |
| Over 10-inch                                | 3-1/2-inch                    |

B. Arrows shall indicate direction of flows. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6-inches.

C. Where pipe passes through a wall, use pipe markers and directional arrows on each side of the wall.

D. Use pipe markers and directional arrows every 50 feet along continuous pipe lines.

- E. Use a pipe marker and directional arrow at each rise and "T" joint.
- F. When using directional arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional arrow.
- G. The Engineer will assist in determining pipe content and direction of flows.

3.05 CLEANUP:

- A. The Contractor shall at all times keep the premises free from accumulation of waste material and rubbish caused by his employees or work. At the completion of the painting, he shall remove all of his tools, scaffolding, surplus materials, and all of his rubbish from and about the buildings and shall leave his work "broom clean" unless more exactly specified.
- B. The Contractor shall also, upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, glass, hardware, etc., leaving the work ready for inspection.

END OF SECTION

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## SECTION 10 14 16

### PLAQUES

#### 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 metal plaques.

##### 1.03 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.
- C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Plaques: Half-size Sample.
  - 2. Exposed Accessories: Half-size Sample of each accessory type.
- E. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plaques to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
  - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PLAQUES

- A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. A.R.K. Ramos.
    - b. ACE Sign Systems, Inc.
    - c. Gemini Signage; Gemini, Inc.
  - 2. Plaque Material: Cast bronze
  - 3. Plaque Thickness: 0.50 inch
  - 4. Finishes:
    - a. Integral Metal Finish: As selected by Architect from full range of industry finishes
    - b. Overcoat: Manufacturer's standard baked-on clear coating



5. Background Texture: As selected by Architect from manufacturer's full range.
6. Integrally Cast Border Style: Square single line, polished
7. Applied Frame Material, Style, and Finish: As indicated on Drawings
8. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] <Insert requirement>.
9. Text and Typeface: Accessible raised characters and Braille & Typeface as selected by Architect from manufacturer's full range

## 2.02 MATERIALS

- A. Bronze Castings: ASTM B584, alloy recommended by manufacturer and finisher for finish indicated
- B. Bronze Plate: ASTM B36/B36M, alloy recommended by manufacturer and finisher for finish indicated

## 2.03 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
  3. Plaque Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.
    - b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by plaque manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.04 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
  6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

## 2.05 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 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.
- B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
  - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
  - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  - 2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
  - 3. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.
  - 4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.
  - 5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of plaque and of suitable quantity to support weight of plaque without slippage. Keep strips away from edges to prevent visibility at plaque edges. Place plaque in position, and push to engage tape adhesive.
  - 6. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach plaques to plate using method specified above.

### 3.03 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as plaques are installed.
- C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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SECTION 10 14 19  
DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast dimensional characters.
2. Related Requirements:
  - a. Section 13 42 00: PRE-ENGINEERED METAL BUILDING; For coordination of dimensional letter signage in metal panel wall assemblies.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
- B. Thermal Movements: For exterior fabricated channel dimensional characters >, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 2.02 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. A.R.K. Ramos.
    - b. ASI Sign Systems, Inc.
    - c. Gemini Incorporated.
  - 2. Character Material: Cast aluminum
  - 3. Character Height: As indicated on Drawings
  - 4. Finishes:
    - a. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designation aluminum finishes

1. Shop-applied Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - MetalFinishes Manual, and the following:
  - a. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
  - b. Finish Coating shall be manufactured as one of the following products:
    - 1) Akzo Nobel; product: "Trinar Ultra."
    - 2) P.P.G. Industries Inc.; product "Duranar."
    - 3) Valspar Corp., product: "Fluoropon."
  - c. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
  - d. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
  - e. Shop finish with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.

5. Mounting: Concealed studs

## 2.03 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. For exterior exposure, furnish stainless-steel unless otherwise indicated.
  3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  4. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

- b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
  - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.04 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
  - 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  - 6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.



## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  - 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
  - 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  - 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
  - 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of

sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION

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## SECTION 10 14 20

### BUILDING SIGNAGE

#### 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. High-Density Urethane Seals
  - 2. Field Applied, Vinyl Character Signage

##### 1.03 COORDINATION

- A. Furnish templates for placement of embedment installation method in permanent construction by other installers.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Dimensional Characters: Full-size Sample of each type of dimensional character.
  - 2. Exposed Accessories: Half-size Sample of each accessory type.

3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

E. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

#### 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

#### 1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

#### 1.07 FIELD CONDITIONS

A. Field Measurements: Verify locations of items embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

#### 1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Deterioration of finishes beyond normal weathering.
- b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

- 1. Uniform Wind Load: As indicated on Drawings
- 2. Concentrated Horizontal Load: As indicated on Drawings
- 3. Other Design Load: As indicated on Drawings
- 4. Uniform and concentrated loads need not be assumed to act concurrently.

- B. Thermal Movements: For exterior items, allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.02 EXTERIOR HIGH-DENSITY URETHANE TOWN SEAL

- A. High-density urethane foam sign board, consisting of the following characteristics:

- 1. Density (ISO 1183): 10.0 lb/ft<sup>3</sup>.
  - 2. Compressive strength (ISO 604): 280 – 430psi
  - 3. Coefficient of thermal expansion (ISO 1183): 10-6K-1 in/in/FX10-6): 14-19
  - 4. Flexural strength (ISO 178): 280 – 430psi

- B. Acceptable manufacturers:

- 1. Signs By Tomorrow, Newton, MA (Basis of Design).
  - 2. Lexington Signs and Grafix, Burlington, MA.
  - 3. Foam by Design, Clearwater, FL.
  - 4. Coastal Enterprises, Orange, CA

## 2.2 FIELD-APPLIED, VINYL-CHARACTER SIGNS

- A. Field-Applied, Vinyl-Character Sign: Characters die cut from 2-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI Sign Systems, Inc.; LTV Series Dimensional Letters or a comparable product by one of the following:
    - a. APCO Graphics, Inc.
    - b. Best Sign Systems, Inc.
    - c. Mohawk Sign Systems, Inc.
  - 2. Sizes: As indicated.
  - 3. Substrate: As indicated.
  - 4. Text and Font: As scheduled.
  - 5. Colors: As selected by Architect from manufacturer's full range.

## 2.03 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

- 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:

- a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant spanner-head or one-way-head slots unless otherwise indicated.
- 4. Sign Mounting Fasteners:
  - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
  - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
  - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.04 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  - 5. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

## 2.05 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 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.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
  - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
  - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
- 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
- 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
- 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- 6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

### 3.03 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION



## SECTION 10 14 23.16

### ROOM-IDENTIFICATION PANEL SIGNAGE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes identification signs for rooms and exit signs that are directly attached to building walls or doors.
- B. Related Requirements:
  - 1. Section 08 17 43- AF COMPOSITE DOORS
  - 2. Section 09 29 00 – GYPSUM BOARD: For coordination mounting room signage on adjacent walls from doors.

##### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room identification exit signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size
- C. Samples: For each exposed product and for each color and texture specified.

##### 1.03 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

##### 1.04 CLOSEOUT SUBMITTALS

- A. Maintenance data.

##### 1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in ANSI A117.1, 2009.

### 2.02 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign, Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI Sign Systems, Inc.
  - b. Signature Signs, Inc.
  - c. Signs & Decal Corp.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
  - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign
  - b. Surface-Applied Graphics: Applied photo image
  - c. Subsurface Graphics: Reverse halftone or dot-screen image
  - d. Color(s): As selected by Architect from manufacturer's full range
3. Sign-Panel Perimeter: Finish edges smooth.
  - a. Edge Condition at Vertical Edges & Horizontal Edges: Square cut
  - b. Corner Condition in Elevation: Square
4. Backer Panel, of same material and color as signage, required at all glass mounted locations, Interior & Exterior.
5. Mounting: adhesive

### 2.03 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings

## 2.04 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
  - 3. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

## 2.05 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
  4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION

## SECTION 10 21 13.19

### PLASTIC TOILET COMPARTMENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

###### B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for blocking of overhead toilet partitions, floor mounted and overhead braced.
2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

##### 1.02 COORDINATION

- ###### A.
- Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall.

##### 1.03 ACTION SUBMITTALS

###### A. Product Data:

1. Solid-plastic toilet compartments:
  - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

###### B. Shop Drawings: For solid-plastic toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

###### C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

- D. Samples for Verification: Actual sample of finished products for each type of toilet compartment indicated.
  - 1. Size: 6-inch- square, of same thickness indicated for Work.
  - 2. Include each type of hardware and accessory.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Certificates:
  - 1. Product Certificates: For each type of toilet compartment by manufacturer.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments.

#### 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Door Hinges: One hinge with associated fasteners.
  - 2. Latch and Keeper: One latch and keeper with associated fasteners.
  - 3. Door Bumper: One bumper with associated fasteners.
  - 4. Door Pull: Two door pull(s) with associated fasteners.
  - 5. Fasteners: 10 fasteners of each size and type.

#### 1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- B. Regulatory Requirements: Comply with applicable provisions in for toilet compartments designated as accessible ICC, ANSI A117.1, 2009.

## 2.02 SOLID-PLASTIC TOILET COMPARTMENTS

- 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. ASI Global Partitions.
  - 2. General Partitions Mfg. Corp.
  - 3. Scranton Products.
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung
- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
  - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
  - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
  - 3. Color and Pattern: as selected by Architect from manufacturer's full range
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
  - 1. Polymer Color and Pattern: Contrasting with pilaster, as selected by Architect from manufacturer's full range
- F. Brackets (Fittings):
  - 1. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or extruded aluminum.
    - a. Polymer Color and Pattern: Contrasting with panel, as selected by Architect from manufacturer's full range
- G. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

## 2.03 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless steel, cam type that swings to a closed or partially open position allowing emergency access by lifting door. Mount with through bolts.
  - 2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply

- with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
  4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at outswinging doors Mount with through bolts.
  5. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.04 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221.
- C. Brass Castings: ASTM B584.
- D. Brass Extrusions: ASTM B455.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless Steel Castings: ASTM A743/A743M.
- G. Zamac: ASTM B86, commercial zinc-alloy die castings.

## 2.05 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.



- D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts.
- E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet compartments and 36-inch- wide, outswinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls with full-height brackets.
    - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust, so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

### 3.03 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

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## SECTION 10 22 13

### WIRE MESH PARTITIONS

#### 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. Heavy-duty wire mesh partitions with passage doors and hardware.

##### 1.03 DEFINITIONS

- A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.
- B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Indicate clearances required for operation of doors
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: 12-by-12-inch panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.
- E. Delegated-Design Submittal: For wire mesh partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wire mesh partition hardware to include in maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Door Locks: Furnish 5 percent of quantity installed for each type indicated, but no fewer than 10 locks.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Inventory wire mesh partition door hardware on receipt and provide secure lockup for wire mesh partition door hardware delivered to Project site.
  - 1. Tag each item or package separately with identification and include basic installation instructions with each item or package.

1.010 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Acorn Wire & Iron Works.
  2. American Wire Corporation.
  3. California Wire Products Corporation.
  4. Indiana Wire Products, Inc.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design wire mesh units.
- B. Structural Performance: Wire mesh units shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft. at any location on a panel.
  2. Total load of 300 lbf applied uniformly over each panel.
  3. Concentrated load and total load need not be assumed to act concurrently.
- C. Seismic Performance: Wire mesh units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.5

### 2.03 MATERIALS

- A. Steel Wire: ASTM A510.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.
- C. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.
- D. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513, Type 5, mandrel-drawn mechanical tubing.
- F. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.
- H. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in

concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
- I. Power-Driven Fasteners: ICC-ES AC70.
- J. Seismic Bracing: Angles with legs not less than 1-1/4 inch wide, formed from 0.040-inch-thick, metallic-coated steel sheet; with bolted connections and 1/4-inch-diameter bolts.
- K. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.
  1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- L. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.
- M. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

#### 2.04 HEAVY-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.192-inch-diameter, intermediate-crimp steel wire woven into 2-inch diamond mesh.
- B. Mesh: 0.192-inch-diameter steel wire, resistance welded into 1-1/2-by-2-1/2-inch rectangular mesh.
- C. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/8-inch cold-rolled steel channels; with holes for 3/8-inch-diameter bolts not more than 12 inches o.c.
- D. Horizontal Panel Stiffeners: Two cold-rolled steel channels, 1 by 1/2 by 1/8 inch, bolted or riveted toe to toe through mesh.
- E. Top Capping Bars: 3-by-1-inch steel channels.
- F. Posts for 90-Degree Corners: 1-1/2-by-1-1/2-by-1/8-inch steel angles or tubes or 2-by-2-by-0.075-inch cold-rolled steel angles or tubes, with holes for 3/8-inch-diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch steel base plates.
- G. Posts for Other-Than-90-Degree Corners: 2-inch-OD by 1/8-inch steel pipe or round tube, with holes for 3/8-inch-diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch steel base plates.
- H. Line Posts: 3-inch-by-4.1-lb or 3-1/2-by-1-1/4-by-1/8-inch steel channels; with 1/4-inch steel base plates.
- I. Three-and Four-Way Intersection Posts: 2-by-2-by-0.075-inch steel tubes, with holes for 3/8-inch-diameter bolts aligned for bolting to adjacent panels; with 1/4-inch steel base plates.

- J. Floor Shoes: Metal, not less than 2 inches high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- K. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch steel channels, banded with 1-1/2-by-1/8-inch flat steel bar cover plates on four sides, and with 1/8-inch-thick angle strike bar and cover on strike jamb.
  - 1. Hinges: Full-surface type, 3-1/2-by-3-1/2-inch steel, three per door; bolted, riveted, or welded to door and jamb framing.
  - 2. Padlock Lug: Mortised into door framing and enclosed with steel cover.
  - 3. Cylinder Lock: Mortise type with manufacturer's standard cylinder operated by key outside and lever inside; mounted in lower section of door.
  - 4. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.
- L. Accessories:
  - 1. Sheet Metal Base: 0.060-inch-thick, steel sheet.
  - 2. Adjustable Filler Panels: 0.060-inch-thick steel sheet, capable of filling openings from 2 to 12 inches.
  - 3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch of adjustment.
- M. Finish: Powder-coated finish unless otherwise indicated.
  - 1. Color: As selected by Architect from manufacturer's full range

## 2.05 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.
  - 1. Fabricate wire mesh items to be readily disassembled.
  - 2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint
- B. Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
  - 1. Mesh: Weld mesh to framing.
  - 2. Framing: Fabricate framing with mortise and tenon corner construction.
    - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
    - b. Fabricate three-and four-way intersections using manufacturer's standard connecting clips and fasteners
    - c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 to 4 inches of clear space between finished floor and bottom horizontal framing.
4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
5. Doors: Align bottom of door with bottom of adjacent panels.
  - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

## 2.06 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- B. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.
  1. Color and Gloss: As selected by Architect from manufacturer's full range

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where wire mesh items will be installed.
- C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 WIRE MESH PARTITIONS ERECTION

- A. Anchor wire mesh partitions to floor with 3/8-inch-diameter postinstalled expansion anchors at 12 inches o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.
  1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
- B. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing and as follows:



1. For concrete and solid masonry anchorage, use expansion anchors.
  2. For hollow masonry anchorage, use toggle bolts.
  3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
- C. Secure top capping bars to top framing channels with 1/4-inch-diameter "U" bolts spaced not more than 28 inches o.c.
- D. Provide line posts at locations indicated or, if not indicated, as follows:
1. For partitions that are 7 to 9 feet high, spaced at 15 to 20 feet o.c.
- E. Provide seismic supports and bracing as indicated or, if not indicated, as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.
- F. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
- G. Install doors complete with door hardware.
- H. Weld or bolt sheet metal bases to wire mesh partitions and doors.
- I. Bolt accessories to wire mesh partition framing.

### 3.03 ADJUSTING AND CLEANING

- A. Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 "PAINTING"
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

## SECTION 10 26 00

### WALL AND DOOR PROTECTION

#### 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. Corner guards.
- 2. End-wall guards.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
  - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
  - 1. Include Samples of accent strips and accessories to verify color selection.
- D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
  - 1. Corner and End-Wall Guards: 12 inches long. Include example top caps.

##### 1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of handrail.
- B. Material Certificates: For each type of exposed plastic material.

- C. Sample Warranty: For special warranty.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

#### 1.06 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. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 60-inch-long units.
  - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
  - 2. Keep plastic materials out of direct sunlight.
  - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard covers in a horizontal position.

#### 1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products[ of each type] from single source from single manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; 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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1, current version
- C. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated as one piece from PVC plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
  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. Construction Specialties, Inc.
    - b. Nystrom, Inc.
    - c. WallGuard.com.
  2. Wind Size: Nominal 3-inch- long legs and 1-inch corner radius
  3. Height: 8 feet
  4. Mounting: Countersunk screws through factory-drilled mounting holes
  5. Color and Texture: As selected by Architect from manufacturer's full range
- D. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
  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. Babcock-Davis.
    - b. Construction Specialties, Inc.
    - c. Nystrom, Inc.
  2. Material: Stainless-steel sheet, Type 304

- a. Thickness: Minimum, 16 GA
- b. Finish: Directional satin, No. 4
- 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches
- 4. Corner Radius: 1/8 inch
- 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes

## 2.03 END-WALL GUARDS

- A. Surface-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over including mounting hardware.
  - 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. Construction Specialties, Inc. (Based on Acrovyn Model, SM-10 series)
    - b. Nystrom, Inc.
    - c. WallGuard.com.
  - 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:
    - a. Profile: Nominal 3-inch- long legs and 1-inch corner radius
    - b. Height: 8 feet
    - c. Color and Texture: As selected by Architect from manufacturer's full range
  - 3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
  - 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
- B. Surface-Mounted, Metal, End-Wall Guards: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
  - 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 Floor Products Company, Inc.
    - b. WallGuard.com.
    - c. Construction Specialties, Inc. (C-S Group) (Based on Model CO Series)
  - 2. Material: Stainless-steel sheet, Type 304
    - a. Thickness: Minimum, 16 GA
    - b. Finish: Directional satin, No. 4
  - 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches
  - 4. Corner Radius: 1/8 inch
  - 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes

## 2.04 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required; thickness as indicated.
- B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.
- C. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.
- D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- E. Adhesive: As recommended by protection product manufacturer.

## 2.05 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.06 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.03 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
  - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
  - 3. Adjust end and top caps as required to ensure tight seams.

### 3.04 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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## SECTION 10 28 00

### TOILET, BATH, AND LAUNDRY ACCESSORIES

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

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

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Public-use washroom accessories.
  - 2. Toilet-compartment occupancy-indicator systems.
  - 3. Public-use shower room accessories.
  - 4. Underlavatory guards.
  - 5. Custodial accessories.

##### 1.03 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.
- B. Samples: For each exposed product and for each finish specified, full size.
  - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.



1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

#### 1.07 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, visible silver spoilage defects.
  2. Warranty Period: 15 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Toilet-Compartment Occupancy-Indicator Systems: Manufacturer agrees to repair or replace toilet-compartment occupancy-indicator systems that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
  1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
  2. Shower Seats: Installed units are able to resist 360 lbf applied in any direction and at any point.

#### 2.02 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser (TTD):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are limited to the following:
  - a. Kimberly Clark, Coreless, Jumbo Roll Toilet Tissue Paper Dispenser, Product Code #09608
2. Description: Coreless, Double-roll dispenser
3. Mounting: Partition mounted, serving two adjacent toilet compartments and / or Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle
5. Capacity: Designed for 5.9-inch-diameter tissue rolls.
6. Material and Finish: Black
7. Lockset: No Key

A. Soap Dispenser (SD):

8. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are limited to the following:
  - a. S.C. Johnson Professional, Stoko Refresh Foaming Hand Soap Dispenser, #STO-30290
9. Description: Designed for manual operation and dispensing soap in lather form.
10. Mounting: Vertically oriented, surface mounted
11. Capacity: 800 ml
12. Materials: White with grey push button
13. Lockset: N/A
14. Refill Indicator: Window type.

B. Paper Towel Dispenser (PTD):

15. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are limited to the following:
  - a. Kimberly Clark, Sanitouch, Manual Hard Roll Towel Dispenser, Product Code #09990
16. Description: Single roll paper towel dispenser
17. Mounting: Vertically oriented, surface mounted
18. Materials: Black
19. Lockset: Tumbler type.
20. Refill Indicator: Window type.

C. Semi-Recessed Waste Receptacle (SRWR):

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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Mounting: Semirecessed
3. Minimum Capacity: 12 Gallon
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
5. Liner: Reusable vinyl liner
6. Lockset: Tumbler type for waste receptacle.
7. Basis of Design: Bobrick B3644

D. Grab Bar (GBXX):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area
4. Outside Diameter: 1-1/4 inches
5. Configuration and Length: As indicated on Drawings

E. Sanitary-Napkin Disposal Unit (SND)

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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Mounting: Partition mounted, dual access and/ or surface mounted
3. Door or Cover: Self-closing, disposal-opening cover
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

F. Mirror Unit (MIRR):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI American Specialties, Inc.; ASI Group.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
2. Frame: Stainless steel channel
  - a. Corners: Manufacturer's standard
3. Size: 18-inch x 30-inch
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant

G. Coat / Robe Hook (CH):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI American Specialties, Inc.; ASI Group.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
2. Description: Double-prong unit
3. Mounting: Exposed
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

2.03 TOILET-COMPARTMENT OCCUPANCY-INDICATOR SYSTEM

A. Toilet-Compartment Occupancy-Indicator System:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Tooshlights; Modus Systems, LLC.
2. Description: Battery-powered latch and electrically powered indicator-light system. Latches communicate wirelessly with separate, overhead indicator lights.
3. Latch: Slide operation.
  - a. Compatibility: Provide latch compatible with compartment doors indicated for Project.
  - b. Power Source: Two AA batteries.
    - 1) Low-Battery Warning: Indicator light pulses when associated batteries of corresponding latch require replacement.

- c. Patch Kit: Stainless steel in manufacturer's standard finish, adhesively applied to interior and exterior of compartment door to cover existing hardware locations.
- d. Latch Material and Finish: Matte chrome-plated, die-cast zinc alloy (zamac); installed with stainless steel fasteners.

## 2.04 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

### B. Shower Curtain Rod (CR)

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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Description: 1-1/4-inch- outside diameter, straight rod.
3. Configuration: As indicated on Drawings
4. Mounting Flanges: Concealed in material and finish matching rod
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

### C. Shower Curtain (SC)

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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Nylon-reinforced vinyl, minimum 9 oz. or 0.008-inch- thick vinyl, with integral antibacterial and flame-retardant agents
4. Color: As selected from manufacturer's full range
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

### D. Coat / Robe Hook (CH) :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ASI American Specialties, Inc.; ASI Group.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
- 2. Description: Double-prong unit
  - 3. Mounting: Exposed
  - 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

## 2.05 UNDERLAVATORY GUARDS

### A. Underlavatory Guard:

- 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. Plumberex Specialty Products, Inc.
  - c. Truebro; IPS Corporation.
- 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
- 3. Material and Finish: Antimicrobial, molded plastic, white.

## 2.06 CUSTODIAL ACCESSORIES

### A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

### B. Custodial Utility Shelf (JS):

- 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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
- 2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
- 3. Size: 16 inches long by 6 inches deep
- 4. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, ASTM A480/A480M No. 4 finish (satin).

### C. Custodial Mop and Broom Holder (M/BH):

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. AJW Architectural Products.
  - b. ASI-American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf
3. Length: 36 inches
4. Hooks: Four
5. Mop/Broom Holders: Three spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
  - b. Rod: Approximately 1/4-inch- diameter stainless steel.

## 2.07 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## 2.08 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
  - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

### 3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

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## SECTION 10 44 13

### FIRE PROTECTION CABINETS

#### 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. Fire-protection cabinets for the following:
  - a. Portable fire extinguisher.

- B. Related Requirements:

- 1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

##### 1.03 PREINSTALLATION CONFERENCE

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

- 1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
  - a. Schedules and coordination requirements.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- 2. Show location of knockouts for hose valves.

- B. Shop Drawings: For fire-protection cabinets.

- 1. Include plans, elevations, sections, details, and attachments to other work.

- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

#### 1.06 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

#### 2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- 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.

#### 2.03 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher
  - 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. Babcock-Davis.

- b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
- c. Larsen's Manufacturing Company.

B. Cabinet Construction: Nonrated

- 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet

- 1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

- 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet

F. Door Material: Steel sheet

G. Door Style: Vertical duo panel with frame

H. Door Glazing: Tempered float glass (clear)

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

- 1. Provide projecting lever handle with cam-action latch
- 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

- 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- 3. Break-Glass Door Handle: Manufacturer's standard, integral to glass with the words "PULL TO BREAK GLASS" applied to handle.
- 4. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
- 5. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle
- 6. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

- a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER"
  - 1) Location: Applied to cabinet door
  - 2) Application Process: Pressure-sensitive vinyl letters
  - 3) Lettering Color: Red
  - 4) Orientation: Vertical
7. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603
  - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - c. Color: As selected by Architect from manufacturer's full range
2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 6 mm thick, Class 1 (clear)

L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated
  - a. Identify fire extinguisher in security fire-protection cabinet with the words "FIRE EXTINGUISHER"
    - 1) Location: Applied to cabinet door
    - 2) Application Process: Pressure-sensitive vinyl letters
    - 3) Lettering Color: Red
    - 4) Orientation: Vertical
3. Keys: Three per door lock.

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: As selected by Architect from full range of industry colors

## 2.04 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Miter corners and grind smooth.
  - 3. Provide factory-drilled mounting holes.
  - 4. Prepare doors and frames to receive locks.
  - 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  - 2. Fabricate door frames of one-piece construction with edges flanged.
  - 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.05 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semi recessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Prepare recesses for semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.03 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide Semi-recessed fire-protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification:
  - 1. Apply vinyl lettering at locations indicated.

### 3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 10 44 16  
FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
  - 1. Section 10 44 13 "Fire Protection Cabinets." Coordinate with sizes specified for fire extinguishers that are smaller than the bracket / wall hung fire extinguishers.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
    - a. Schedules and coordination requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.07 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Badger Fire Protection; a Carrier company.
    - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
    - c. Kidde; Carrier Global Corporation.



- d. Larsen's Manufacturing Company.
- 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
- 3. Valves: Manufacturer's standard
- 4. Handles and Levers: Manufacturer's standard
- 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated, 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
  - a. For coordination with semi-recessed fire extinguisher cabinets.
- C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated, 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
  - a. For coordination with bracket hung locations.

## 2.03 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Badger Fire Protection; a Carrier company.
    - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
    - c. Kidde; Carrier Global Corporation.
    - d. Larsen's Manufacturing Company.
  - 2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  1. Mounting Brackets: Lever of Fire Extinguisher to be at 48 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

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## SECTION 10 51 13

### METAL LOCKERS

#### 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. Welded Restroom lockers.
  - 2. Locker benches, Fixed and Moveable

##### 1.03 PREINSTALLATION MEETINGS

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

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: For metal lockers.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show locker trim and accessories.
  - 3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- E. Samples for Verification: For the following products, in manufacturer's standard size:
  - 1. Lockers and equipment.
  - 2. Locker benches.

- F. Product Schedule: For lockers.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

#### 1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
    - a. Locks.
    - b. Blank identification plates.
    - c. Hooks.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Deliver master and control keys

#### 1.09 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

#### 1.010 COORDINATION

- A. Coordinate sizes and locations of concrete and/or pressure treated wood bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

## 1.011 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of latches and other door hardware.
  - 2. Damage from deliberate destruction and vandalism is excluded.
  - 3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations: Obtain metal restroom and gear lockers, locker benches, and accessories from single source from single locker manufacturer.
  - 1. Obtain locks from single lock manufacturer.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", ICC A117.1, and 521 CMR.

### 2.03 WELDED RESTROOM LOCKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, Basis of Design is , Single Tier, Quiet Corridor Lockers as manufactured by Republic Storage Systems:
  - 1. AJW Architectural Products.
  - 2. Lyon LLC.
  - 3. Penco Products, Inc.
  - 4. Republic Storage Systems, LLC.
- B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
  - 1. Size: 18x24
  - 2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
  - 3. Door Style: Vented panel as follows:

- a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier, three louver openings at top and bottom for double-tier, two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier lockers.
- C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
  1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
  2. Backs: 0.048-inch nominal thickness.
  3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
  1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
  1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
  2. Continuous Hinges: Manufacturer's standard, steel, full height.
  3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- F. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
  1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.
    - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
    - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- G. Locks: Combination padlocks
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- I. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.
- J. Coat Rods: Manufacturer's standard.

- K. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
  - 1. Closures: Vertical-end type.
- L. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- M. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- N. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- O. Materials:
  - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
  - 2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.
- P. Finish: Baked enamel or powder coat.
  - 1. Color: As selected by Architect from manufacturer's full range

## 2.04 LOCKER BENCHES

- 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. AJW Architectural Products.
  - 2. ASI Storage Solutions.
  - 3. Lyon LLC.
- B. Provide bench units with overall assembly height of 17-1/2 inches for movable benches.
- C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
  - 1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick except provide 20- to 24-inch-wide tops where accessible benches are indicated.
  - 2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 3. Extruded aluminum with clear anodic finish.
- D. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/2-inch-diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
  - a. Color: As selected by Architect from manufacturer's full range.
- E. Movable-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top, complete with fasteners, and as follows:
  1. Aluminum: 1/8-inch-thick by 3-inch-wide channel or 1/4-inch-thick by 3-inch-wide bar stock, shaped into inverted-T form; with nonskid pads at bottom with baked-enamel finish.
    - a. Color: As selected by Architect from manufacturer's full range
- F. Materials:
  1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
  2. Plastic Laminate: NEMA LD 3, Grade HGP.
  3. Extruded Aluminum: ASTM B221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
  4. Steel Tube: ASTM A500/A500M, cold rolled.
  5. Particleboard: ANSI A208.1, Grade M-2.

## 2.05 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
  1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
  2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
  1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
  2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
  3. Triple-Tier Units: One double-prong ceiling hook.
  4. Coat Rods: For each compartment of each locker
  5. Open-Front Athletic Lockers: Two single-prong wall hooks bolted to locker back and coat rod.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups.



Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

- E. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches above the floor.
  - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
  - 1. Sloping-top corner fillers, mitered.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- I. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- J. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- K. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

## 2.06 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
  - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers and to floor / base assembly.
  - 3. Anchor back-to-back metal lockers to floor.
- B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
  - 1. Attach hooks with at least two fasteners.
  - 2. Attach door locks on doors using security-type fasteners.
  - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
    - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    - b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach recess trim to recessed metal lockers with concealed clips.
  - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
  - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
  - 4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
  - 5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

- E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 48 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- F. Movable Benches: Place benches in locations indicated on Drawings.

### 3.03 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

### 3.04 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13

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SECTION 10 75 16  
GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes ground-set flagpoles made from aluminum
- B. Owner-Furnished Material: Flags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles.
  - 1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
  - 2. Include section, and details of foundation system.
- C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- D. Delegated-Design Submittal: For flagpoles.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design flagpole assemblies.
- B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
  - 1. Wind Loads: Determine according to NAAMM FP 1001.
  - 2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

### 2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
  - 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 Flagpole.
    - b. Concord American Flagpole.
    - c. Eder Flag Manufacturing Company, Inc.
    - d. Morgan-Francis Flagpoles and Accessories.
    - e. US Flag & Flagpole Supply, LLC.
- B. Exposed Height: 30 feet
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

1. Flashing Collar: Same material and finish as flagpole.
- E. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
  1. Flashing Collar: Same material and finish as flagpole.
- F. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.
  1. Furnish ground spike.
- G. Hinged Baseplate: Cast-metal tilting hinged base and anchor plate joined by permanently secured pivot rod. Furnish with stainless-steel screws for securing tilting base to anchor plate when not tilted; furnish with anchor bolts.
  1. Finish: Same as flagpole.
  2. Furnish aluminum base or aluminum flashing collar finished to match flagpole.
  3. Furnish ground spike.

## 2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
  1. 0.063-inch spun aluminum, with gold anodic finish.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
  1. Halyard Flag Snaps: Chromium-plated bronze swivel snap hooks. Furnish two per halyard.
  2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Furnish two per halyard.

## 2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.
- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C33/C33M, fine aggregate.
- D. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.6 ALUMINUM FINISHES

- A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44
  - 1. Color: As selected by Architect from full range of industry colors and color densities
  - 2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.
- G. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

### 3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and]manufacturer's written instructions.

- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.
- C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION



## SECTION 11 11 29

### LUBRICATION DISPENSING SYSTEM

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all sections within DIVISION 01 -GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

##### 1.2 DESCRIPTION OF WORK:

- A. This Section specifies the Fluid Dispensing System and is defined to include, but not necessarily limited to:
  - 1. Furnishing and installing a complete waste fluid collection system and fluid distribution system at locations indicated on the Contract Drawings.
  - 2. Acceptance testing.
  - 3. Training of the Owner's personnel.
  - 4. Maintenance of the system during the warranty period.
- B. Furnish and install where shown on the Drawings all equipment, as specified, complete and ready for safe operation. Each item shall be specifically designed for the intended function. Provide necessary accessories, items of equipment, mechanical, electrical and structural items, whether specified or not in order to provide properly installed and functional equipment.
- C. Equipment shall be suitable for installation in the space allocated on the Drawings and operation on the available building utilities. Any modification or redesign to the building structure or utilities because of an alternate equipment selection by the Vendor/Contractor shall be provided by the Vendor/Contractor at no additional cost to the Owner, and shall be as approved by the Engineer.
- D. In all cases where a device or part of the equipment is referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.
- E. Related Work: the following items are not included in this section and will be performed under the designated Sections:
  - 1. Division 26, ELECTRICAL

## 1.02 QUALITY ASSURANCE

- A. Model numbers indicated are to establish a minimum standard of quality.
- B. Work shall conform to Federal, State and local governing rules and regulations and ordinances, including OSHA, 527 CMR 1.00, and NFPA requirements, and shall pass inspection by the authorities having jurisdiction.
- C. Work shall conform to State of Massachusetts Building Code, consisting of current versions of the following codes with all subsequent amendments:
  - 1. International Building Code and Amendments as adopted.
  - 2. International Plumbing Code.
  - 3. National Electrical Code,
  - 4. International Fire Code.
  - 5. State Model Energy Conservation Code.
  - 6. International Mechanical Code.
- D. Furnish all materials and labor above and beyond those required by these specifications in order to meet these requirements and to obtain approvals of inspections and tests.
- E. General:
  - 1. All articles, materials, fittings, equipment and machinery incorporated in the work shall be new and unused, of recent manufacturer, free from defects and imperfections, and shall, as far as practicable, be manufacturer's standard make and shall be of first grade commercial quality, from reputable manufacturers, suitable for the purpose intended and subject to approval of the Engineer.
  - 2. When two or more items of equipment are required, they shall be products of a single manufacturer.
  - 3. All work shall be performed in a neat and workmanlike manner by workers skilled in their respective trades, and all materials and equipment shall be installed as recommended by the manufacturers and in accordance with specified codes and standards.
  - 4. Touch-up or repaint to match original finishes, all factory finished or painted equipment and materials which are scratched or marred during shipment or installation.
- F. Permits and Tests: The Contractor shall obtain necessary construction and/or operating permits from the State and other authorities having jurisdiction, make application and file all drawings required for such permits, and pay for all permits. Contractor shall arrange for inspections and tests required by governing authorities and by the Owner and the State of Massachusetts, and pay all costs connected therewith. Contractor shall obtain and file with the Town and State written evidence that all the above requirements have been met. All permits shall be in place

(acknowledged in writing) and all testing shall be complete prior to substantial completion.

G. Certificates:

1. Furnish an affidavit certifying that all materials and workmanship comply with the applicable code requirements.
2. Before final acceptance, furnish all required certificates of the authorities having jurisdiction.

H. Certificates of Compliance:

1. Upon delivery of the equipment, submit certificates of compliance. Each certificate shall be signed by an authorized representative of the manufacturer stating that the equipment and its installation comply in all respects with the Contract requirements.

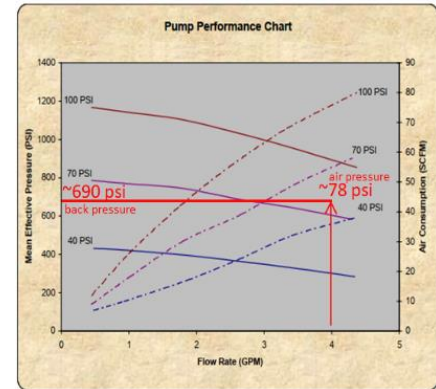
F. Lube system contractor shall be from a reputable firm able to demonstrate a minimum of five years' experience in pump sizing, installing and servicing fluid distribution system for vehicle maintenance applications.

G. The Contractor shall guarantee that the components furnished are compatible and that the completed system shall be satisfactory and operational in all locations.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Submit shop drawings, catalog cuts and all manufacturers' data covering all equipment covered in this section.
- B. System vendor shall provide hydraulic calculations, and certification that the system is complete, with all appurtenances/equipment needed to operate as intended, sealed by a Massachusetts Professional Engineer listing all components and their requirements, as indicated but not limited to those listed below. The contractor's stamping engineer shall verify the equipment types/model numbers listed in this specification and shall modify them as needed to provide a complete and operable system. The contractor's stamping engineer shall certify that the lube system piping, valves, and other components are rated to the appropriate back pressure generated during system operation, to ensure a leak free system.
- C. Hydraulic calculation shall include all equations, assumptions variables required to complete calculations including, but not limited to; pipe length, pipe diameter, flow rate, fluid viscosity at 65°F, number of fittings, elevation change, etc.

- D. Pump performance charts shall be provided showing total system back pressure and air consumption on the y-axis and flow rate on the x-axis, with a redline mark up showing the approximate air pressure requirement for the proposed pump to deliver the specified fluids through the system at the design flow rate. See example mark up of a pump performance chart to the right. Stamped calculations and performance charts shall demonstrate that the air requirements for the pump at the specified product flow rate fall between the pump's standard minimum and maximum operating pressures. Contractor shall adjust the pump model where necessary to meet this requirement, and the pump shall be equivalent quality to the pump specified.



- E. The manufacturer shall submit a minimum of three locations where similar equipment has been provided and installed including date placed in service; provide contact information for people that are familiar with the project, and the name of the local service company that maintains replacement parts and provides warranty service.

#### 1.05 JOB CONDITIONS

- A. The Vendor/Contractor's equipment and proposed materials shall be at least of the same level of quality as that indicated and specified.
- B. Work includes furnishing and installation of heat actuated shut-off valves, shutoff valves, check valves, flexible hydraulic hose, distribution piping and fittings, fluid solenoid valves, fluid hose reel assemblies including support framing, control handles, pump systems, above ground tanks and all other work and material to provide an approved working installation as shown in the Drawings and as specified.
- C. Unless otherwise specified, any materials described, shown, reasonably implied, or obviously a part of the system and necessary to its complete finish and perfect operation shall be furnished and installed, without extra charge. The Drawings and specifications are intended to supplement each other, and any item set forth in either shall be recognized as the same as if fully set forth in both.
- D. The Vendor/Contractor shall be responsible for coordinating all of the materials and equipment to provide a complete fully operational fluid dispensing system. Information provided on the Drawings and specifications are requirements to be used as guidelines to assist the Contractor and the lube system design engineer.
- E. Where design information is not specifically noted on the Contract Drawings, it shall be the responsibility of the Contractor and the lube system design engineer to develop

such design information as required by the manufacturer for a complete operational system.

- F. The various component parts shall function together as a workable fluid dispensing system, complete with everything necessary for its operation and with all equipment properly adjusted and in working order.
- G. Vendor/Contractor shall provide complete maintenance and operation manuals for all of the fluid dispensing equipment under this section.
- H. All components of the lubrications system shall be provided by a single source vendor to insure the Owner receives a complete and operable system.

#### 1.06 WARRANTY

- A. Following completion, the manufacturer shall provide the Owner with a one (1) year warranty minimum starting at project acceptance, covering all parts, materials, and labor. The lubrication pumps and reels will have a five (5) year manufacturer's warranty. Where equipment comes with longer warranty period, such as the pumps, the longer period shall be valid. All warranty work shall be performed by a local manufacturer's authorized distributor at the project location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment will be the responsibility of the Manufacturer.
- B. Warranty: All equipment shall be warranted in accordance with the following provisions:
  - 1. The Contractor warrants that the work performed, and all materials and equipment furnished hereunder by Contractor or his subcontractors or suppliers will be free from defects in design, material, workmanship and operation for a period of one years from the date of substantial completion except for special warranties as may be specified in the individual sections.
  - 2. The Contractor shall remedy any such defect at his own expense.
  - 3. The Contractor shall furnish written warranties, prior to final acceptance of the equipment item, required by the respective sections of the Specifications for time stipulated therein. These warranties shall be in writing, on the Contractor or supplier's letterhead and shall be included in the operations and maintenance manual(s) as specified elsewhere in this section.
  - 4. Major equipment components, (as required by the respective sections of the specifications), specifically those manufactured by other than the primary equipment supplier, shall be covered by their own respective warranties, which shall not be less than the supplier's standard warranty. These warranties shall also be included in the operations and maintenance manual(s).

5. Nothing in these requirements, conditions or specifications including OWNER'S right to a complete inspection shall constitute a disclaimer or limit, negate, exclude or modify in any way any warranty created hereunder.

## PART 2 – PRODUCTS

### 2.01 WALL MOUNTED PUMPS (MC-7)

- A. All fluid distribution pumps shall be designed for high fluid flow at medium pressure for large fleets, auto dealers, and construction equipment maintenance facilities. The following pumps for the listed fluids shall be furnished and installed by the Lube System contractor:
  1. One (1) 12:1 or 10:1 ratio wall mounted ball pump for 15W-40 Oil
  2. Two (2) 6:1 or 5:1 ratio wall mounted ball pump for 0W-20, 0W-30
- B. 12:1 Wall Mounted Ball Pumps for 15W-40 Engine Oil shall be Power Master Series III Model 2014 as manufactured by Lincoln industrial. Approved alternatives are Alemite industrial oil pump model 7793-C (12:1) or Graco model Fireball 425 (10:1). The lube pumps shall have the following features and construction:
  1. Air motor with 30-200 psig of working pressure.
  2. Six-inch stroke per cycle.
  3. Air motor to allow for integrated automatic air shut off to prevent run away condition (with 6-inch diameter air motor).
  4. Ball check seats with Grade 25 quality.
  5. Integrated muffler to meet or exceed OSHA noise requirements.
  6. Fully pneumatic, modular design, corrosion resistant air motor.
  7. Pump tube to contain carbon steel plunger case hardened to depth of .010" with polyurethane seal arrangement.
  8. Pumps will be 12:1 ratio
  9. Pumps shall be wall mounted with all necessary mounting brackets
  10. Hose or 2, pressure hose, air inlet hose filter regulator
  11. Filter – Lincoln Model No. 600112
  12. Regulator – Lincoln model No. 600012
  13. Thermal relief valve (1,800 PSI max. allowable pressure)- Lincoln Model No.282876
  14. Air supply hose – 5 feet minimum of ½-inch hose, Lincoln Model No.74060
  15. Oil pressure hose - 5 feet minimum of ½-inch medium oil pressure hose Lincoln Model No. 73060
  16. Anti-run on valve
  17. Low level cut-off
  18. Surge Suppression limited to 100-psi, and pressure relief valve
- C. 6:1 Wall Mounted Ball Pump for 0W-20, 0W-30, and Hydraulic Fluid shall be Power Master Series III Model 2051 as manufactured by Lincoln industrial. Approved

alternatives are Alemite industrial oil pump model 7783-C4 (6:1) or Graco model Fireball 425 (6:1). The lube pumps shall have the following features and construction:

1. Air motor with 30-200 psig of working pressure.
  2. 3-inch air motor bore diameter
  3. 3.25-inch stroke per cycle.
  4. Oil output from pump equal for both up and down stroke.
  5. Stall pressure equal for both up and down stroke.
  6. Separate high-pressure seals for air motor and pump tube.
  7. 6.7 cu. in. output per cycle.
  8. 34.5 cycles per gallon
  9. Air motor to allow for integrated automatic air shut off to prevent run away condition.
  10. Ball check seats with Grade 25 quality.
  11. Integrated muffler to meet or exceed OSHA noise requirements.
  12. Fully pneumatic, modular design, corrosion resistant air motor.
  13. Pump tube to contain carbon steel plunger case hardened to depth of .010" with polyurethane seal arrangement.
  14. Pumps will be 6:1 ratio
  15. Pumps shall be wall mounted with all necessary mounting brackets
  16. Hose or 2, pressure hose, air inlet hose filter regulator
  17. Filter – Lincoln Model No. 600108
  18. Regulator – Lincoln model No. 600008
  19. Thermal relief kit (900 PSI rating) – Lincoln Model No. 277601-1
  20. Air supply hose – 5 feet minimum of ½-inch hose, Lincoln Model No. 74060
  21. Oil pressure hose – 5 feet minimum of ½-inch medium oil pressure hose Lincoln Model No. 73060
  22. Low-level cut off -Lincoln Model No. 82439
  23. Surge Suppression and pressure relief valve limited to 100 PSI.
  24. Run away prevention/anti-run on prevention system.
- D. All components to be verified by the lube system design engineer, and modified as needed. Pumps shall be equipped with all required appurtenances and components necessary for a complete and operable system as recommended by the manufacturer and lube system design engineer.

## 2.02 REEL BANKS (MC-8)

- A. Contractor shall provide a reel bank supported from the ceiling. They shall be supplied with the following reels:
1. 0W-20 Motor Oil
  2. 0W-30 Motor Oil
  3. 15W-40 Motor Oil
  4. Electrical Reel
  5. ½" Air Reel

B. Features shall conform to the following features and Construction for each reel:

1. Heavy-duty lube reel.
2. Fifty (50) feet of ½"-I.D. Oil hose
3. Reel latch that automatically locks at desired position
4. Ball stop included
5. Maximum pressure: 1,500 psi
6. Material Inlet/Outlet: ½" NPTF(m)
7. Fluid distribution reel handles shall be properly installed to prevent leaking.

C. Reels shall be Product #8078-D with hoses for motor oil with all accessories as required for a complete reel system as manufactured by Alemite or approved equal.

D. Engine oil reels shall come equipped with an Alemite 3670-M mechanical dispenser approved equal, as shown on the plans. All components to be verified by the contractor's lube system stamping engineer, and modified as needed.

E. The electric reels shall be model 7260 as manufactured by Alemite, or approved equal, and shall include/conform to the following features and construction:

1. Forty five (45) feet cord length
2. Reel latch that automatically locks at desired position
3. Duplex outlet with GFCI
4. 115V/20A power requirements
5. 12 gauge cord size
6. NEMA 5-15 plug with 5 ft power connection cord to supply power to reel

## 2.03 WASTE FLUID PUMP EVACUATION SYSTEM (MC-6)

A. One (1) pumps required:

1. MC-6: Provide one (1) wall-mounted waste oil pump evacuation system for evacuating waste oil from rolling drain pans and deliver waste oil by overhead piping to the Waste Oil Storage Tank inside the Fluid Storage Room. See Drawings for pump locations.

B. Features and Construction for waste fluid evacuation system:

1. Wall-mounted pump: material hose on input side of pump shall be equipped with removable quick connect fluid connector on the input end that is compatible with coupler on the rolling drain pan collector unit. A second removable open fitting shall also be provided that can be easily installed by the Owner to draw used oil out of an open container.
2. Power Factor: 1:1 ratio
3. Suction Kit
4. Air requirements: 60-120 psi



5. Air Hose: Rated for 175 PSI minimum air pressure
  6. Fluid Hose: Rated for proper pressure – 1800 psi, ½-inch
  7. Hose and Fitting Kit
  8. Low level cut-off
  9. Provide air filter, air regulator and gauge, water separator, drain port, and lubricator for airline connection
  10. Runaway valve
  11. 150-psi Pressure Relief Valve
  12. Ball-type shut-off valves
  13. Surge Suppression limited to 100-psi
  14. Provide bushings as necessary for motor to hose connection
  15. Attachments: Suction Kit Lincoln Model No. 84945
  16. Bare stub
  17. Wall mount bracket to support pump
- C. The waste fluid pump shall be Model No. 4100 1-inch UL diaphragm provided with complete pump kit and all above accessories and other appurtenances as required for a complete waste fluid pump evacuation system as manufactured by Lincoln Industrial, St. Louis, MO; Samson, or Graco.

## 2.04 SERVICE LABELS

- A. Provide metal labels for all of the service reels and pumps included in these specifications. Include a label for each reel.
- B. Labels will be metal labels, 3-1/4 inch wide x 4-1/4 inch long minimum with preprinted label.
- C. Provide all mounting hardware to mount all labels on pumps and reels.
- D. Service labels shall be as manufactured by Lincoln Industrial, St. Louis, MO; or approved equal, with the above minimum requirements.

## 2.05 REEL SUPPORT FRAMING

- A. Reel supplier shall be responsible for furnishing appropriate framing for the hanging of the overhead reels from the building structure. Reel support framing will begin at the bottom of the framing steel reel supports as shown on the drawings. Threaded rod hangers will not be allowed.
- B. All materials required to affix the frame to the building structure and the reels to the frame are the responsibility of the reel supplier.

## 2.06 FLUID DISPENSING PIPING

- A. All fluid main and branch line piping shall be seamless steel Swagelok type compression fittings with 1-inch seamless tubing minimum, or approved equal. The lube system Vendor shall provide piping/fittings and valves rated for the appropriate back pressure developed during fluid pumping activities. Steel tubing shall be stainless steel in accordance with manufacturer's recommendations by the Contractor.
- B. The lube system Vendor shall provide stainless steel piping/fittings and valves rated for the appropriate back pressure developed during fluid pumping activities.
- C. The lube system contractor shall also provide an electronic motorized ball valve controlled by an adjustable electronic timer at a location 4 feet above the floor as shown on the Plumbing and Electrical Drawings. The Plumbing Contractor shall install the motorized ball valve and the Electrical Contractor shall provide power to the ball valve and the time clock, Electrical Contractor shall also install the Time Clock. The motorized ball valve shall be Watts Model LFEMVII – 6400-SS or equal, sized to fit the airline shown on the Plumbing Drawings and the time clock shall be Omega Model PTC-15 or equal. The Owner shall be able to adjust the time on the time clock so that the air supply to all lube system pumps in the fluid storage room is shut-off automatically at the time selected by the Owner. The timer shall also open the valve automatically at a pre-set time, and shall be equipped with a manual over-ride. The lube system contractor shall complete the initial programming of the time clock, with input provided from the Owner. A twist spring wound timer override switch for the time clock shall also be provided and installed to allow the Owner to override the time clock and use the fluid distribution system during off hours without resetting the time clock.
- D. One Heat-actuated shut-off valve shall be located on the main air supply line in the fluid storage room feeding all of the air operated pumps at a point 4 feet above the finished floor. The lube system contractor shall provide the heat actuated shut off valve and the Plumbing Contractor shall install the valve. Heat actuated shut-off valve shall be as follows:
  - 1. Spring-loaded seat disc open position maintained by a fusible link. Valve shuts at 212 degrees F temperature to shutdown lines carrying flammable fluids. Body material shall be bronze. Maximum pressure rating shall be 300 psi. Valve shall have a 212 degrees F fusible link. Acceptable manufacturers are Cashco FL Series, or approved equal by Assured Automation or, Valtorc.
- E. All piping shall be security fastened so as to prevent shaving and potential leaks and movement. Pipe may be hung/secured using threaded rod provided the total length of threaded rod does not exceed 2-inches, unless otherwise approved by the engineer, to prevent pipe swaying/movement. Piping shall be secured in accordance with manufacturers recommendations.

- F. The waste oil pipe shall be run tight to the structure including the ceiling and walls. The pipe shall not be allowed to run from the ceiling down to a lower mezzanine level without the support of a permanent wall. All structure penetrations shall be sealed to maintain wall/ceiling assembly fire rating.

## 2.07 FLUID DISPENSING PIPING IDENTIFICATION

- A. Provide pipe markers on all fluid dispensing piping in accordance with ANSI A 13.1 standards.
- B. Pipe markers to be: Seton Opti-Code; material indicator on pressure-sensitive vinyl sheet with Seton Arrows-On-A-Roll; direction-of-flow arrows.
- C. Provide identification of all piping with heating tape concealed on top the insulation so that it is easily visible.
- D. Pipe markers shall be as manufactured by Seton Identification Products; Brady Corporation; Champion America, Inc; or approved equal, with the above minimum requirements.
- E. Contactor shall install pipe markers per manufacturer's installation recommendations.

## 2.08 VALVES

- A. Valves shall be ball type or other approved equal, and shall be specified by the lube system design engineer, and shall be rated for the appropriate back pressure.

## 2.09 PIPE SUPPORT

- A. Products of Grinnel, Superstrut, B-Line, and PHD Manufacturing or approved equal will be accepted. Hangers, supports and accessories used shall be applied in accordance with the manufacturer's recommendation for type of service and application. All supports, rods and accessories shall be galvanized.

## 2.10 WASTE FLUID STORAGE TANK HIGH LEVEL ALARM (MC-9)

- A. Waste Fluid Tank Alarm: Contractor shall furnish and install a new tank alarm at each new waste fluid pump out station (MC-6) as indicated on the drawings. The waste fluid tank alarm shall tie into the tanks high level floats in accordance with manufacturer recommendations. Provide compressed air line automatic shut-off system, which consists of an electrically operated valve tied into the waste fluid tank alarm. This system will serve to shut air off to the existing waste fluid pumps when the fluid level reaches 90% of the tank capacity. The system shall be installed in accordance with the lube system contractor/manufacturer recommendations. The Contractor shall provide the necessary equipment, materials, and wiring, in

accordance with the lube system contractor/manufacturer recommendations in order to provide a complete and operable system.

B. The tank alarm shall be Model TA-732 as manufactured by Warrick Controls; Omntec, OPW or approved equal and shall conform to the following requirements:

1. Unit shall be intrinsically safe.
2. Unit shall be equipped with auxiliary contact for remote annunciation or cutoff.
3. Unit shall be equipped with two channels
4. Unit shall be equipped with two conduit connection hubs.
5. Unit sound level shall be adjustable from 77 to 97 dB at 2-feet
6. Unit shall have red LED indicating a fault condition.
7. Unit shall have a yellow LED indicating fault condition has occurred even if fault has cleared itself.
8. Unit shall have green LED indicating unit has power.
9. Unit shall be equipped with an acknowledgement button allowing direct alarm silencing.
10. Unit shall be equipped with a test button to allow alarm activation and system testing.
11. Supply Voltage: 120 VAC +10%/-15%, 6.6 VA Max
12. Indicators: Red, Green, and Yellow solid state LED
13. Enclosure: NEMA 4x
14. Sensor Voltage: 12 VAC or 12 VDC
15. Terminals: size 6 pan head screws with captive wire clamping plate
16. Temperature: -22 F to +150 F
17. Sensitivity: 0-26K Ohm Maximum specific resistance
18. Maximum Wire Run: 1000 feet (14 or 16 gauge MTW or THHN wire)
19. Conduit Connection: ¾-inch FNPT
20. Interface Contacts: Normally open dry (sensor normally dry)
21. All alarm wiring shall be installed within galvanized steel rigid conduit
22. Alarm shall be electrically hard wired. Alarms equipped with plugs are not acceptable.

## 2.11 TANK FLOATS AND SENSORS

A. Contractor shall furnish and install one (1) tank monitoring level float for the waste fluid tank (MC-6) as shown on the equipment drawings.

1. Tank level float shall be compatible with the TA-732-A-O alarm panel.
  2. Float should be single pole double throw switch, normally open dry type.
  3. Tank level float shall be Model No. LS-800 as manufactured by Gem Sensors and Controls, Plainville, CT, Warrick Controls or other approved equal.
  4. Level Float shall be a single level monitoring float.
  5. Float shall be U.L. listed and intrinsically safe to operate in a Class I Hazard Area.
  6. Stem shall be 316 stainless steel.
  7. Stem length shall be determined by the float manufacturer and shall be in accordance with the tank and lubrication manufacturers.
  8. Float material shall be 316 stainless steel and shall be compatible with the associated fluids.
  9. Float shall have 2-inch NPT mounting fitting compatible for direct installation with the tanks specified.
  10. Float stops shall be set to cut the air supply to the waste pumps and trigger the high level alarm at 90% capacity of the tank.
  11. Floats stops and appurtenances shall be 316 stainless steel.
  12. All float/alarm wiring shall be installed within galvanized rigid steel conduit.
- B. The Contractor shall provide the necessary equipment, materials, and wiring, in accordance with the lube system contractor/manufacturer recommendations in order to provide a complete and operable system.

## 2.12 FLUID STORAGE TANKS (MC-5 & MC-6)

- A. Contractor shall provide the following two (2) double wall fluid compartment storage tanks:
1. MC-5: New Fluid Compartment Tank (600-Gallons)
    1. 300-Gal 15W-40
    2. 180-Gal 0W-30
    3. 120-Gal 0W-20
  2. MC-6: Waste Oil Tank (400-Gallons)
- B. Features and Construction for tanks:
1. Material: double-walled steel
  2. Meet NFPA and UL-142 requirements
  3. Lifting lugs
  4. Tank openings (minimum requirements per each tank, or tank compartment for split tanks):

- i. 3 - 2-inch spares
  - ii. 1 - 2-inch fill
  - iii. 1 - 2-inch discharge/pump-out assembly
  - iv. 1 - 2-inch working vent
  - v. 1 - 2-inch mechanical gauge/spare
  - vi. 1 - 4-inch primary tank emergency vent
  - vii. 1 - 6-inch secondary containment emergency vent
  - viii. 1 - 2-inch secondary containment monitoring port
  - ix. 1 - 2-inch monitoring port/spare
  - x. 1 - 2-inch secondary working vent
- C. The oil storage tanks shall be Lube Cube with all above accessories as required for the oil storage tanks as manufactured by Containment Solutions, Inc.; Highland Tank, Turner Tanks or approved equal.
- D. ASTs shall be equipped with visual level gauges in accordance with manufacturer's recommendations. The visual level gauges shall have the following:
  - 1. 2-inch male NPT threads
  - 2. 301 Stainless steel rods
  - 3. Lexan lens cover
  - 4. Polypropylene and aluminum float
  - 5. Leak guard shall be as manufactured by Morrison Bros Model 718 or approved equal by Husky Red Fox Gauge or approved equal.
- E. The interstitial space of the ASTs shall be monitored using a leak guard sight glass gauge for double walled tanks. The leak guard shall have the following:
  - 1. 2-inch NPT tank fitting
  - 2. Stainless steel rods
  - 3. Aluminum linkage
  - 4. Nitrophyl float
  - 5. Leak guard shall be as manufactured by BJE Model Jarhead or approved equal by Kreuger Sentry Gauge.
- F. Lube contractor shall provide four (4) overfill prevention valves, one for each fluid storage tank compartment for the new fluid tank (MC-2). Overfill prevention valves shall be as manufactured by manufactured by Universal Valve Company Model No. 47-20 or approved equal.
- G. New fluid tank/compartment fill ports shall be equipped with an overfill prevention valve model no. 47-20; a 2-inch diameter drop tube, model no. 723; a 2-inch cam-

and-groove coupling adapter, model no. 49-C; and a 2-inch aluminum socket type coupling cap, all by Universal Valve Company Model or approved equal.

- H. Waste fluid tank/compartments pump out ports shall be equipped with a 2-inch diameter drop tube, model no. 723; a 2-inch cam-and-groove coupling adapter, model no. 49-C; and a 2-inch aluminum socket type coupling cap all by Universal Valve Company Model or approved equal.
- I. Tank vents shall be equipped with 2" pressure vacuum vent caps.
- J. Tanks shall be painted per manufacturer recommendations and color shall be chosen by the Owner.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

- A. Install equipment in strict accordance, with approved shop drawings and manufacturer's installation instructions at locations indicated in Drawings.
- B. Coordinate installation of the fluid reels at the bays and the pumps supplying service located in the Fluid Storage Room with Drawings and Specifications. Make and provide all connections for proper operation.
- C. The pumps shall supply product to all reels at locations shown on Drawings.
- D. Provide mounting channels and brackets and structural supports (where required) as recommended by manufacturer for reel bank support and connection. Mounting heights as indicated in the drawings. Provide required bracket for such installation, see Structural Drawings for reel bank support framing.
  - 1. Vendor/Contractor to use mounting channels appropriate for each reel installation as provided by Lincoln Industrial or approved equal. Provide connections as required to work in conjunction with structural supports.
- E. Fluid dispensing equipment shall deliver an acceptable amount of fluid as recommended by Owner, with a minimum flow of 2 GPM per reel with a total system GPM of 4 GPM with two reels running simultaneously. The waste oil pump system shall pump waste oil at a minimum flow of 5 GPM to the waste oil tank in the fluid storage room.
- F. The Vendor/Contractor shall provide all air line connections with required air filter, regulator and valves and other appurtenances as needed, as recommended by the lube system design engineer.
- D. Fluid distributor reel handles shall be installed properly to prevent leaking.

- E. Note all pumps shall be mounted on the wall above the tanks/drums in order to prevent excessive product leakage in the event of pump failure.
- F. The Owner shall provide the fluid drums for the system.

### 3.02 FIELD QUALITY CONTROL

- A. Provide the services of qualified manufacturer's representatives to perform the following:
  - 1. Supervise preparatory work performed by other trades.
  - 2. Supervise installation.
  - 3. Coordinate, prior to installation, the mounting requirements of the fluid pumps to the tanks to assure that proper hardware has been provided.
  - 4. Provide shut-off valves at a convenient visible location for emergency shut-off of fluid lines and at each reel for individual service.
  - 5. Prior to substantial completion of the facility, supervise testing, by the Vendor/Contractor in the presence of the Engineer, to ensure proper operation of the equipment.
  - 6. Instruct Owner's personnel in the proper safe operation and maintenance of the equipment.
  - 7. Perform all scheduled and unscheduled maintenance during warranty period; provide all labor and materials.

### 3.03 EQUIPMENT TEST AND CHECK-OUT

- A. Before Substantial Completion, the Vendor/Contractor-furnished equipment shall be tested in the presence of the Engineer to his satisfaction and demonstrated to be correctly connected and installed. Submit a testing schedule to the Engineer for approval prior to the start of the equipment test and check-out.
- B. Testing and check-out procedures of the manufacturer shall be carried out completely.
- C. The Owner will provide vehicles and vehicle components to be used during the testing procedures as required by the Vendor/Contractor and approved by the Engineer.
- D. Equipment tests shall not only be performed to demonstrate that the equipment has been properly installed and connected and operates properly but also to demonstrate that the equipment performs the work for which it is intended.
- E. Tested equipment found to be defective or inoperable to any extent shall be reported to the Engineer immediately.
- F. Any operating difficulty or defective item shall be repaired or replaced and put into proper operation by the Vendor/Contractor immediately, at no additional expense to



the Owner.

- G. Protect equipment and surrounding areas from damage resulting from testing operations. Clean-up spills or leakage from testing.
- H. The Vendor/Contractor shall bear all expenses of all tests, including the furnishing of all necessary instruments, lubricants, hydraulic fluid, supplies, data recorders, and operation personnel, Provide and bear all expenses for fuel/power required to operate the equipment during the tests.
- I. At the sole discretion of the Engineer, the Vendor/Contractor may be required by repeat any tests, at no cost to the Owner.

### 3.04 TRAINING PROGRAM

- A. General Requirements: The Vendor/Contractor is responsible for training the Owner's personnel.
  - 1. Maintenance management classes are to take place prior to substantial completion of the facility.
  - 2. Mechanics training will commence only after installation of system is complete at the garage.
  - 3. Training Shall be conducted at the new Maintenance Facility.
  - 4. Hours for training are to be between 9:00 a.m. and 5:00 p.m. unless specifically permitted otherwise

END OF SECTION

SECTION 11 24 23  
FALL PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish the following items for installation under related sections as indicated:
  - 1. Pre-engineered fall arrest system for attachment to standing seam metal roof system installed under Section 13 42 00 – PRE-ENGINEERED METAL BUILDING.
  - 2. Mezzanine fall arrest system for attachment to the underside of the pre-engineered metal building frames installed under Section 13 42 00 – PRE-ENGINEERED METAL BUILDING.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- B. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Shop and field formed flashing.
- C. Section 13 42 00 – PRE-ENGINEERED METAL BUILDING: Installation of fall protection system provided under this Section.

1.03 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. AISC S342L - Load and Resistance Factor Design Specification for Structural Steel Buildings (including Supplement No.1).
  - 2. AWS D1.1/D1.1M - Structural Welding Code—Steel.
  - 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 4. ASTM A167 - Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
  - 5. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
  - 6. OSHA 1910, Subpart D, Walking and Work Surfaces.
  - 7. OSHA 1910, Subpart F, Appendix C, Personal Fall Arrest Systems.
  - 8. The NRCA Roofing and Waterproofing Manual, Fifth Edition.

#### 1.04 SUBMITTALS

1. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 – SUBMITTALS
  2. Product Data: Manufacturer's complete product data and specifications for all items to be furnished hereunder.
  3. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
  4. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  5. Manufacturer's installation instructions.
  6. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in State of Massachusetts.
    - a. Submit shop drawings showing complete layout and configuration of tieback anchor system, including components and accessories.
    - b. Indicate design and fabrication details, hardware, and installation details.
    - c. Include installation instructions, required restrictive working usage and general safety notes, non-restrictive working usage and general safety notes.
  7. Delegated Design Submittals:
    - a. Provide calculations for loading and stresses bearing the Professional Structural Engineer's seal. Show how design load requirements and other performance requirements as required by the Massachusetts State Building Code.
    - b. Coordinate with pre-engineered metal building manufacturer/engineer for loading requirements on roof panel system.
- A. Closeout Submittals: Submit the following under provisions of Section 01 78 00– Project Closeout.
1. Submit standard manufacturer warranty documents as specified.
  2. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Engineer and local Building Official having jurisdiction.

#### 1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
  2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
- B. Regulatory Requirements.
1. Comply with OSHA regulations as follows:
    - a. Appendix C to 1910 Subpart F, Personal Fall Arrest Systems.
      - i. Licensed Professionals: Provide the services of a Professional Structural

Engineer, registered in the State of Massachusetts to design, and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by the Massachusetts State Building Code, 780 CMR.

- ii. Prepare shop drawings for tieback anchor system under direct supervision of a same Engineer experienced in design of this work.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

#### 1.07 PROJECT AMBIENT CONDITIONS

- A. Installation Location: Assemble and erect components only when temperatures are above 40 degrees F (4 degrees C).

#### 1.08 SEQUENCING

- A. Sequence with other Work and Comply with window washing equipment manufacturer's written recommendations for sequencing construction operations.

#### 1.09 WARRANTY

- A. Project Warranty: Refer to Contract Conditions for additional project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.
- C. Warranty: Commencing on date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.02 MANUFACTURERS

- A. Manufacture and type: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Pro-Bel Group.
- B. Insurance: Ensure manufacturer carries liability insurance to protect against product and system failure in amount of five million dollars US (\$5,000,000) minimum.

#### 2.03 PERFORMANCE REQUIREMENTS

- A. Design system fall arrest safety anchors to AISC S342L (including Supplement No.1) and ANSI/IWCA I-14.1, and as follows:
  - 1. Comply with OSHA 1910, Subpart F, Appendix C.

2. Fall Arrest Safety Anchors:
    - a. Fall arresting force safety factor of 2 to 1 without permanent deformation: 1,800 lbs (8.0 kN) minimum.
    - b. Fall arrest force against fracture or detachment: 5,000 lbs (24 kN) minimum.
- B. HANDS FREE HORIZONTAL LIFELINE FOR STANDING SEAMMETAL ROOF PANELS
1. Stainless steel to ASTM A492, Type 316, 0.3125 inches minimum diameter cable, 9127 lbs ([40] kN) minimum breaking strength with permanently swaged cable ends.
  2. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
  3. Standard intermediate support brackets: Stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
  4. Secured to standing seams of standing seam metal roof panels with no penetrations.
  5. Mobile intermediate support brackets: multi position, stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
  6. Corner units: 90 degrees and 135 degrees flexible corner units from manufacturer's standard components to meet project requirements.
  7. End terminal hardware: Stainless steel swaged termination at one end and stainless steel tensioner with shock absorber at other end to meet project requirements.
  8. Lanyard cable runner: Stainless steel to ASTM A167, Type 316 with automatic runner bypass for continuous "hands-free" operation.
  9. Ensure lanyard can be inserted or removed anywhere on cable.
  10. Harness: Manufacturer's standard full body harness and lanyard with shock absorber.
  11. Basis of Design Manufacturer: Pro-Bel Group of Companies, Union City, CA, product: "Hands Free Horizontal Cable Lifeline System" or approved equal.
    - a. Acceptable manufacturers:
      - 1) Pro-Bel Group of Companies, Union City, CA.
      - 2) Hy-Safe Technology, Union Grove, WI
      - 3) Tractel, Ltd., Anjou, Quebec
- C. MEZZANINE SELF-RETRACTING LANYARD (SRL) ATTACHMENT POINT
1. Safety & Tie Back Anchors
    - a. Safety U-bars: Type 304 stainless steel with yield strength of 35 Ksi (240 MPa) . U-bar to be not less than 3/4" (19 mm) diameter material

with 1-1/2" (38 mm) eye opening.

- b. Securement bolts: mild steel, Type 300W with yield strength of 44 Ksi (300 MPa), hot-dip galvanized to ASTM A123/A123M-2002.
  - c. Hollow steel section (HSS) piers: mild steel, Type 300W with yield strength of 50 Ksi (350 MPa). Wall thickness to suit application,[hot dipped galvanized to ASTM A123/A123M-2002.
  - d. Base plate and all other sections: galvanized mild steel as above with yield strength of 44 Ksi (300 MPa). Thickness and securement to suit application.
  - e. Miscellaneous bolts, nuts and washers: mild steel, Type 300W with yield strength of 44 Ksi (300 MPa), hot-dip galvanized to ASTM A123/A123M-2002 or Type 304 stainless steel with yield strength of 35 Ksi (240 MPa).
- 2. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
  - 3. Standard intermediate support brackets: Stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
  - 4. Corner units: 90 degrees and 135 degrees flexible corner units from manufacturer's standard components to meet project requirements.
  - 5. End terminal hardware: Stainless steel swaged termination at one end and stainless steel tensioner with shock absorber at other end to meet project
  - 6. Harness: Manufacturer's standard self retracting lanyard that complies with ANSI Z259.1
  - 7. Connecting Components (carabiners and snap hooks) used with the system shall comply with ANSI Z259.12
  - 8. Shock Absorbing Lanyards and SRL used with the system shall comply with ANSI Z259.13
  - 9. Basis of Design Manufacturer: Pro-Bel Group of Companies, Union City, CA, product: "Self Retracting Lanyard Tie Back and Attachment Point" or approved equal.
    - a. Acceptable manufacturers:
      - 1) Pro-Bel Group of Companies, Union City, CA.
      - 2) Hy-Safe Technology, Union Grove, WI
      - 3) Tractel, Ltd., Anjou, Quebec

## 2.04 SOURCE QUALITY CONTROL

- A. Ensure equipment components and materials are from single manufacturer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Installation of fall protection system, is included under Section 13 42 00 –  
PRE- ENGINEERED METAL BUILDING.

END OF SECTION

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## SECTION 11 30 13

### RESIDENTIAL APPLIANCES

#### 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. Microwave appliances
  - 2. Cooktop / Electric Range with Oven
  - 3. Under Cabinet – Cooktop Hood / Vent
  - 4. Refrigeration / Freezer appliances

##### 1.03 PREINSTALLATION MEETINGS

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

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- C. Product Schedule: For appliances.

##### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.



- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

#### 1.07 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:
  - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Refrigerator/Freezer, Icemaker, Sealed System: Full warranty, including parts and labor, for on-site service on the product.
  - 1. Warranty Period for Sealed Refrigeration System: Two years from date of Substantial Completion.
  - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
  - 3. Warranty Period: Three years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in 521 CMR ( MA Accessibility Code)

#### 2.02 MICROWAVE OVENS

- A. Microwave Oven:
  - 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, Basis of Design, UMC5225G as manufactured by Whirlpool:
    - a. Frigidaire.
    - b. KitchenAid; Whirlpool Corporation.
    - c. Whirlpool Corporation.

2. Mounting: Free standing / Countertop
3. Type: Conventional
4. Dimensions:
  - a. Width: 24 inches +/-
  - b. Depth: 19-1/2 inches +/-
  - c. Height: 12-1/2 inches +/-
5. Capacity: 2.2 cu. ft.
6. Oven Door: Door with observation window and pushbutton latch release
7. Microwave Power Rating: 1200 W
8. Electric Power Supply: As indicated on electrical Drawings
9. Controls: Digital panel controls and timer display.
10. Other Features: Turntable
11. Material: Stainless steel

## 2.03 COOKTOP / ELECTRIC RANGE WITH OVEN

### A. Cooktop / Electric Range with Oven:

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, Basis of Design, **WEE515SALS**, as manufactured by **Whirlpool**:
  - a. GE Appliances
  - b. KitchenAid; Whirlpool Corporation.
  - c. Whirlpool Corporation.
2. Type: electrical / Freestanding
3. Dimensions:
  - a. Width: 29-7/8 inches +/-
  - b. Depth: 28-15/16 inches +/-
  - c. Height: 34 inches +/- (Front of unit)
4. Burners: 4 Burners
5. Electric Power Supply: As indicated on electrical Drawings
6. Controls: Built-in Knobs in front of Electric Cooktop
7. Material: Stainless steel

## 2.04 UNDER CABINET – COOKTOP HOOD / VENT

### A. Cooktop Hood / Vent (Under Cabinet)

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, Basis of Design, **BCSD136SS**, as manufactured by **Broan**:

- a. Broan
  - b. KitchenAid; Whirlpool Corporation.
  - c. Whirlpool Corporation.
  - d. GE Appliances
2. Mounting: Under cabinet (Coordinate with millwork shop drawings)
  3. Ducted: Yes (Coordinate with HVAC contractor and requirements)
  4. Type: electrical
  5. Dimensions:
    - a. Width: 36 inches +/-
    - b. Depth: 19-5/8 inches +/-
    - c. Height: 6 inches +/- (Back of unit)
  6. Electric Power Supply: As indicated on electrical Drawings
  7. Controls: 2-speed rocker
  8. Options: Lighting, Grease filter meshes
  9. Material: Stainless steel

## 2.05 REFRIGERATOR/FREEZERS WITH ICE MAKER AND WATER DISPENSER

- A. Refrigerator/Freezer, French Door refrigerator / freezer with freezer on bottom and complying with AHAM HRF-1.

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, Basis of Design, WRFF3436RZ, Stainless Steel as manufactured by Whirlpool:
  - a. Frigidaire.
  - b. LG Electronics USA, Inc.; LG Electronics Inc.
  - c. Whirlpool Corporation.
2. Type: Freestanding
3. Dimensions:
  - a. Width: 36 inches
  - b. Depth: 35 inches +/-
  - c. Height: 70 inches +/-
4. Storage Capacity:
  - a. Total Storage Capacity: 24.7 cu. Ft.
  - b. Refrigeration Compartment Volume: 18 cu. Ft.
  - c. 3.7lb ice capacity.
  - d. Freezer Volume: 6.7 cu. ft.
  - e. Shelf Area: Adjustable glass shelves
5. General Features:

- a. Ice and Water dispenser on door exterior
  - b. Built-in water-filtration system.
- 6. Refrigerator Features:
  - a. Interior light in refrigeration compartment.
  - b. Compartment Storage: vegetable crisper and meat compartment
  - c. Door Storage: Modular compartments. Gallon- milk-container storage
  - d. Temperature-controlled meat/deli bin.
- 7. Freezer Features: One freezer compartment
  - a. Automatic defrost.
  - b. Interior light in freezer compartment.
  - c. Automatic icemaker and storage bin.
- 8. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
- 9. Appliance Color/Finish: Stainless steel

## 2.06 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

### 3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
  - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After installation, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

## SECTION 12 24 13

### ROLLER WINDOW SHADES

#### 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. Manually 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" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, 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.

- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

- D. Samples for Initial Selection: For each type and color of shadeband material.

- 1. Include Samples of accessories involving color selection.

- E. Samples for Verification: For each type of roller shade.

- 1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
  - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
  - 3. Installation Accessories: Full-size unit, not less than 10 inches long.

- F. Product Schedule: For roller shades.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

#### 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.08 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.

#### 1.09 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.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

### 2.02 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- 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. Draper, Inc.
  - 2. Hunter Douglas, Inc.
  - 3. Springs Window Fashions; SWFcontract.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
  - 1. Bead Chains: Nickel-plated metal
    - a. Loop Length: Full length of roller shade
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Clip, jamb mount
  - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
    - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Crank-and-Gear Operating Mechanisms: Sealed gearbox drive system controlled by crank handle.
  - 1. Crank-Handle Type: Detachable
  - 2. Crank-Handle Length: Manufacturer's standard
- D. 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. Roller Drive-End Location: Right side of interior face of shade



2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method
- E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- G. Shadebands:
1. Shadeband Material: Light-filtering fabric & Light-blocking fabric
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material
    - b. Color and Finish: As selected by Architect from manufacturer's full range
- H. 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 assembly when shade is fully open, but not less than 3 inches
  2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
    - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches
  3. Endcap Covers: To cover exposed endcaps.
  4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
    - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches
    - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
  5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
    - a. Closure-Panel Width: 2 inches
  6. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.

7. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
8. Installation Accessories Color and Finish: As selected from manufacturer's full range

## 2.03 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant. (Basis of Design is "EcoVeil" by MechoShade.
  1. Source: Roller shade manufacturer
  2. Type: 100% thermoplastic olefin, TPO, PVC-free
  3. Weave: Mesh
  4. Thickness: 0.034 inches
  5. Weight: Approximately 12.68 oz/sq yd – 13.57 oz/sq yd
  6. Roll Width: As needed for windows
  7. Orientation on Shadeband: Up the bolt
  8. Openness Factor: 3 percent
  9. Color: As selected by Architect from manufacturer's full range
  10. Provide at all exterior windows, and interior sidelites, door glazing options, and interior storefronts & windows unless it's a muster and/or conference room.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant. (Basis of Design is "Equinox Blackout 0100 Series" by MechoShade.
  1. Source: Roller shade manufacturer
  2. Type: 60% Acrylic and 40% Polyester
  3. Thickness: 0.021 inches
  4. Weight: 14.75 oz/sq yd
  5. Roll Width: As needed for windows.
  6. Orientation on Shadeband: Up the bolt
  7. Features: Washable
  8. Color: As selected by Architect from manufacturer's full range
  9. Provide at all exterior & interior muster room and conference rooms to provide blackout for presentations.

## 2.04 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. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
  3. 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, 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.
  1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: At exterior windows and interior storefronts / glazing systems, all door glass options, and interior windows throughout.

### 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

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## SECTION 12 36 61.16

### SOLID SURFACING COUNTERTOPS

#### 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. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

###### B. Related Requirements:

1. DIVISION 22 "PLUMBING" sinks and plumbing fittings.

##### 1.03 ACTION SUBMITTALS

###### A. Product Data: For countertop materials.

###### B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

###### C. Samples for Initial Selection: For each type of material exposed to view.

###### D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. Wood trim, 8 inches long.
3. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

##### 1.04 INFORMATIONAL SUBMITTALS

###### A. Qualification Data: For fabricator.

## 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

## 1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
  - 1. Build mockup of typical countertop as shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.07 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

## 1.08 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## PART 2 - PRODUCTS

### 2.01 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 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. DuPont; DuPont de Nemours, Inc.
    - b. Formica Corporation.
    - c. LG Hausys, Ltd.
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
  - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.

## 2.02 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WT's "Architectural Woodwork Standards."
  - 1. Grade: Premium
- B. Configuration:
  - 1. Front: Radius edge with apron, 2 inches high with 3/8-inch radius
  - 2. Backsplash: Straight, slightly eased at corner
  - 3. End Splash: Matching backsplash
- C. Countertops: 3/4-inch-thick, solid surface material front edge built up with same material
- D. Backsplashes: 3/4-inch-thick, solid surface material.
- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints: Fabricate countertops without joints.
- G. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.
  - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
  - 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.
- H. Cutouts and Holes:
  - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
    - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
    - c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
  - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

## 2.03 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.



- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
  - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

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## SECTION 12 40 00

### EQUIPMENT, FURNISHINGS AND ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. This Section covers all miscellaneous equipment, furnishings, and tools as indicated herein or on the Drawings.
- B. The Contractor shall provide all equipment, materials, tools, and labor to furnish, assemble and install the furnishings and accessories.
- C. See Contract Drawings for equipment/furnishing/tool quantities.

##### 1.2 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. The Contractor shall submit to the Engineer for review six sets of shop drawings, test reports, and certifications, as indicated herein.

##### 1.3 DESIGN CRITERIA

- A. All equipment supplied shall be the manufacturer's latest and proven design and shall meet all specifications as stated on the models specified. These specifications call attention to certain features but do not purport to cover all details entering into the design of the equipment. Final approval on all equipment shall be given by the Engineer.
- B. Contractor shall be responsible for notification to, and coordination with, other trades. If the equipment provided differed from that specified herein. Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment. Contractor shall coordinate utility requirements for approved equipment with subcontractors to ensure proper services and utilities are provided for approved equipment. Contractor is responsible for providing alternate services for approved equipment at no additional cost to the Owner.

#### PART 2 – PRODUCTS

##### 2.1 WORK BENCHES

###### A. STEEL WORKBENCH (CD-2)

- 1. Contractor to provide the quantity of steel workbenches with a steel top as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Dimensions – 72” L x 36” W x 34” H

- b. 3/16" thick top
- c. 14,000lb. capacity
- d. Unit shall be Durham Standard Workbench HWB-3672-95 or approved equal.

**B. LONG WOOD WORKBENCH (CD-4)**

1. Contractor to provide a long wood workbench as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Dimensions – 96" L x 30" W x 30-37" H (adjustable)
  - b. 500lb. Capacity
  - c. 1-1/2" thick composite wood top with rounded edges
  - d. 14" bottom shelf
  - e. Unit shall be ULINE Industrial Packing Table, Composite Wood Top H-2484-WOOD or approved equal.

**C. ELECTRIC CHARGING STATION WORKBENCH (CD-3, MD-2)**

1. Contractor to provide the quantity of electric charging workbenches with a steel top as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Steel top dimensions – 72-inches x 30-inches
  - b. Channel-shaped stringer that ties legs rigidly together.
  - c. High pressure plastic laminate top
  - d. Front panel with four duplex outlets. Electronics riser with four more duplex outlets
  - e. Benches shall be provided with two wiring kits. Each wiring kit comes with 4 duplex receptacles, on/off switch with pilot light, 8' grounded cord and plug, 15 amp, 115 volt service and circuit breaker
  - f. Bench shall be Tensco Model No. EB-2-3072S or approved equal.
  - g. Bench wiring kit shall be Tensco Model No. WK-1 or approved equal.

**D. HEAVY DUTY WORKBENCH (CD-5, MD-4)**

1. Contractor to provide the quantity of steel workbenches with a steel top as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Dimensions – 72" L x 36" W x 34" H
  - b. 1/4 -inch thick steel plate top
  - c. 14,000 lb. Capacity
  - d. Unit Shall be Durham Extra Heavy Duty Machine Table HWB-3672-95 or approved equal.

#### E. HEAVY DUTY WORKBENCH ON CASTERS (MD-3, ME-5)

1. Contractor to provide the quantity of heavy duty workbenches with casters as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Bench dimensions – 72" L x 36" W x 36" H
  - b. Top thickness – 1/4"
  - c. Includes 2 rigid and 2 locking swivel casters
  - d. Includes (4) 4" 11 gauge legs and bottom shelf with wire decking
  - e. Unit shall be Badass Workbench H3X6WELD-14-WC or approved equal.

#### F. COMPUTER DESK (SIGN SHOP) (SD-2)

1. Contractor to provide a computer desk as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be Global Industrial Mobile Computer Workstation WB694561BKA or approved equal.
  - b. 20-gauge steel with durable baked black enamel finish.
  - c. Lockable 24-5/8"W x 22-7/8"D x 22-5/8"H lower storage with adjustable CPU shelf and rear access holes.
  - d. Fixed middle shelf, 11-1/2"H clearance for printer placement.
  - e. Slide-out keyboard tray with wrist rest area, dimensions 23"W x 21"D.
  - f. Four 5" polyolefin casters (2 swivel with brakes, 2 rigid).
  - g. Top Surface, 47-3/4"W x 24-3/4"H with 1-1/2"H back and end stops; includes wire ties and mounting holes for cable management.

### 2.2 HYDRAULIC HOSE EQUIPMENT

#### A. HYDRAULIC HOSE REEL RACK (ME-6)

1. Contractor shall provide and install the quantity of hose reel racks as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall store 3 hydraulic hoses.
  - b. Overall dimensions shall be 28" W x 30" D x 72" H.
  - c. Unit shall be Gates Hose Reel Rack No. 78186 or approved equal.
  - d. Unit shall have a black finish.

#### B. HYDRAULIC HOSE REEL AND FITTINGS STORAGE (ME-7)

1. Contractor shall provide and install the quantity of hose reel and fitting storage units as indicated on the Equipment Drawings. Unit shall conform to the following requirements:

- a. Unit shall be Gates 78190 Storage Cabinet or approved equal.
- b. 4 rows of sliding shelves for fitting storage
- c. Lower angled section with vertical wire dividers for hose reel storage.

## 2.3 WELDING FABRICATION

### A. OXYGEN/ACETYLENE CAGE (MF-12)

1. Contractor shall provide and install the quantity of welding cages as indicated on the Equipment Drawings. Units shall conform to the following requirements:
  - a. Dimensions shall be 24" L x 24" W x 71" H
  - b. House 4 cylinders of 9.5" diameter or equivalent combination
  - c. OSHA compliant
  - d. Construction: fully-welded steel framing, laser-cut steel door and sides, tamper-resistant stainless steel hinges, powder coated with outdoor-grade coating
  - e. Unit shall be USA Safety CBESTS4SC Gas Cylinder Cabinet, or approved equal.

## 2.4 TIRE EQUIPMENT

### A. TIRE STORAGE RACK (MG-3)

1. Contractor shall provide and install the quantity of heavy-duty tire storage racks as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Double riveted tire support beams for high capacity.
  - b. Storage width of 60-inches.
  - c. Adjustable tire storage levels, adjust levels as requested by Owner to fit tire sizes.
  - d. Minimum capacity 16 tires, 2,000 lbs. per shelf.
  - e. Rack base model shall be TENNSCO ZST-6060S, or approved equal.
  - f. The tire storage rack shall be bolted to the floor or wall in accordance with manufacturer requirements.

## 2.5 STORAGE

### A. PARTS SHELVING (6'x2') (CH-4, MH-8, MH-9, SH-2)

1. Contractor to provide and install the quantity of duty steel storage shelves as indicated on Equipment Drawings. Unit shall conform to the following requirements:
  - a. Minimum shelf dimensions shall be 24-inches deep x 72-inches long x 84-inches high with 5 shelves (one at floor level).
  - b. Decking: 16 gauge, Post: 14 Gauge

- c. Minimum shelf capacity shall be 2,750lbs. per shelf.
- d. Powder coated medium grey
- e. All shelving shall be Tennsco Boltless Shelving 8ZA32, or approved equal.
- f. Provide supports as recommended by the manufacturer to support specified shelf capacity.
- g. Manufacturer shall provide shelving support system which meets seismic requirements of the Massachusetts State Building Code and ASCE Seismic Design Requirements for Non-Building Structures. Manufacturer shall submit appropriate documentation to demonstrate that these requirements have been met.

#### B. METAL STORAGE CABINET (MH-7)

1. Contractor to provide and install the quantity of storage cabinets as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be ULINE Welded Storage Cabinet – 36” x 24” x 74” H-4459 or approved equal.
  - b. Dimensions shall be 36” W x 24” D x 74” H.
  - c. 14-gauge steel with durable powder-coat finish
  - d. Shelf capacity shall be 1,200 lbs.
  - e. 5 shelves, adjustable in 2-1/2” increments
  - f. Padlockable handle with 3-point locking system

#### C. HANGING TOOL STORAGE (MH-9)

1. Contractor to provide and install the quantity of pallet racks with solid wood decking as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Dimensions: 96” W x 36” D x 96” H
  - b. Capacity: 5,000 lbs./pair (beams)
  - c. Provide 7 double arm tool holder per rack.
    - i. Dimensions arms: 31” and 33” L x 1.5” W x 1.5” H
    - ii. Arm units shall be Shelving.com Double Arm Tool Holder, Product Code: DIVIDERARM-DBL or other approved equal.
  - d. Pallet rack units shall be ULINE Interlake Model No. H-7461 or approved equal.

#### D. CANTILEVER RACK (MH-10)

1. Contractor to provide and install the quantity of level arm cantilever racks as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be Jarke Straight Cantilever Rack Item #: 3W588 or approved equal.

- b. Unit shall have 1 side with 8 arms.
- c. Each arm shall have a capacity of 2,000 lbs. for a total capacity of 12,530 lbs.
- d. Unit shall be 8 ft. in height.
- e. Arms shall be 24" long.
- f. Center brace length shall be 72".
- g. Arms shall be straight.
- h. Arms and columns shall be 11-gauge steel.
- i. Rack size width shall be 37".

## 2.6 MISCELLANEOUS

### A. PORTABLE DUST COLLECTOR (CM-5)

1. Contractor to provide and install the dust collector as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be Grizzly G0860 1-1/2 HP Portable Cyclone Dust Collector, or approved equal.
  - b. Motor: 1-1/2 HP, 115V/1ph/15A
  - c. Instake hole size: 6"
  - d. Impeller: 12-3/4" Aluminum
  - e. Airflow capacity: 868 CFM @ 1.8" SP
  - f. Max static pressure: 9.7"
  - g. Filtration: 1 micron
  - h. Filter surface area: 28.1 sq. ft.
  - i. 20-gallon drum collection
  - j. Sound rating: 78dB
  - k. Overall dimensions: 27-1/2" W x 44" L x 70" H.

### B. BENCH VISE (CM-6, MM-10)

1. Contractor shall provide and install the quantity of bench vises as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be Wilton 63304 WS8 or approved equal.
  - b. Jaw width shall be 8".
  - c. Replaceable serrated top jaws
  - d. 360° swivel base with double lockdown for quick and easy positioning
  - e. Designed for general duty applications
  - f. Built in pipe jaws handle various pipe sizes
  - g. Rubber pinch point safety guards
  - h. Large anvil work surface
  - i. 30,000 PSI iron castings

### C. PARTS WASHER (MM-8)

1. Contractor to provide and install the quantity of parts washers as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. 30-gallon sink-on-drum fusible link cover, plastic spigot, cleaning brush, and lamp.
  - b. Manual washing system; solvent drains into drum reservoir.
  - c. Compatible chemistries: Premium Solvent, QSOL 220/300, PD 680 Type II, PRF 680 Type II & III, Odorless Solvent.
  - d. Overall Dimensions: 60" H (152.4 cm) x 19.5" W (49.6 cm).
  - e. Sink Size: 8" H x 33.25" W x 22.25" D (20.4 x 84.5 x 56.6 cm).
  - f. Power Requirements: 115 VAC, 60 Hz, 1.4 A.
  - g. Capacity: Maximum fill 15 gal (56.8 L).
  - h. Unit shall be Safety-Kleen Model 16/30, or other approved equal.

### C. PEDESTAL GRINDER (MM-9)

1. Contractor shall provide and install the quantity of bench grinders as indicated on the Equipment Drawings. Unit shall conform to the following requirements:
  - a. Unit shall be Jet Benchtop Shop Grinder with Stand 8" Diam. JBG-8a/JPS-2A or other approved equal.
  - b. Dimensions: 31"L x 21"W x 19"H
  - c. Motor: 1 HP, 120V, 7A, single-phase; max speed 3,450 RPM
  - d. 5/8" spindle size; 5/8" arbor size
  - e. Grinding Wheels: 8" diameter; wheels included
  - f. Power Cord: 6 ft length;
  - g. Cast iron wheel guards with dust vents.
  - h. Heavy-duty cast iron stand with wide stance base and integrated coolant tank and tool tray on adjustable platform.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Contractor shall install equipment in accordance with manufacturer's requirements.
- B. Contractor to furnish and install supports as required by the equipment manufacturer and building codes to ensure the systems are seismically rated as described above, and shall bolt the equipment to floor and provide other supports as needed.
- C. Contractor shall confirm utility needs prior to installing the equipment and coordinate with all trades as needed.



- D. The General Contractor shall perform all other work necessary to provide a complete and operable system, in accordance with the manufacturer requirements, and shall provide the linear footage of items as indicated on the Drawings.

END OF SECTION

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## SECTION 12 48 13

### ENTRANCE FLOOR MATS

#### 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. Roll-up mats.

##### 1.03 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Shop Drawings:
  - 1. Custom Graphics: Scale drawing indicating colors. Place Owner's Seal on each mat.
- C. Samples: For the following products, in manufacturer's standard sizes:
  - 1. Floor Mat: Assembled sections of floor mat.
  - 2. Frame Members: Sample of each type and color.

##### 1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.01 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Accessibility Standard: Comply with applicable provisions in MA State ADA Code; 521 CMR
- B. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

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## SECTION 13 21 70

### UNDERGROUND FRP STORAGE TANK FOR INDUSTRIAL WASTEWATER

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED:

- A. This section covers furnishing and installing a double-walled underground storage tank, monitoring system, alarm system, piping, and accessories for the industrial waste tank as described herein and as indicated on the drawings.
- B. Tank shall be designed and manufactured of reinforced fiberglass plastic (FRP) or its equivalent in accordance with approved engineering standards and in accordance with 314 CMR 18.08.
- C. All tank(s) shall be equipped with a liquid-level measuring device connected to an audio and light alarm system in accordance with Massachusetts 314 CMR 18.08.
- D. All tank(s) shall be equipped with an interstitial monitoring device between the inner and outer walls to detect leakage in accordance with Massachusetts 314 CMR 18.08.

##### 1.02 RELATED WORK:

- A. Section 00 31 43, PERMITS
- B. Section 01 33 23, SUBMITTALS
- C. Section 01 35 29, HEALTH AND SAFETY PLAN
- D. Section 33 31 13.16, POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS
- E. Section 31 23 00, EARTHWORK
- F. Division 26, ELECTRICAL

##### 1.03 QUALITY ASSURANCE:

- A. Tank manufacturer shall be in the business of manufacturing tanks to Underwriters Laboratories, Inc. (UL) Standard 1316.
- B. Tank manufacturer shall be in the business of manufacturing tanks conforming to the requirements of ASTM D3299 Filament-wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.
- C. All additional certificates and test reports shall be submitted to the Engineer.

##### 1.04 REFERENCES:

- A. The following standards form a part of this specification and indicate the minimum standards required:

American National Standards Institute (ANSI)

ANSI B1.20.1 General Purpose Pipe Threads

American Society for Testing Materials (ASTM)

ASTM D1248 Polyethylene Plastic Molding and Extension Materials

ASTM D1785 Polyvinyl chloride (PVC) Plastic Pipes, Schedules 40, 80 and 120

ASTM D3299 Filament-wound Glass-Fiber-Reinforced Thermoset Resin  
Chemical-Resistant Tanks

Commonwealth of Massachusetts Regulations

314 CMR 18.00 Industrial Wastewater Holding Tank and Container Construction,  
Operation, and Record Keeping Requirements

Massachusetts Highway Department Standard Specifications for Highways and Bridges

M2.01.6 Aggregate and Related Materials

- B. Where differences exist between standards, the Contractor shall use the most conservative. If in doubt, describe differences in writing to the Owner for his approval before performing the work.
- C. The codes and standards listed are the latest as of this publication. Codes and standards are continuously updated. The Contractor shall confirm the construction standard edition enforced by the authority having jurisdiction.
- 1.05 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:
- A. Six (6) complete sets of shop drawings, details, data sheets, and other descriptive drawings and materials as may be required to fully describe the equipment proposed and verify conformance with the contract documents shall be submitted to the Engineer.
- B. Shop drawings of the tank(s) by the tank manufacturer including product data sheets and descriptive material for major components to be provided.
- C. Assembly and installation drawings.

- D. Design calculations demonstrating that the tank is stable against buoyancy forces produced by groundwater. Buoyancy calculations shall be based on groundwater at grade when tank is completely empty. Calculations shall be prepared and stamped by a Massachusetts Registered Professional Engineer.
- E. Details on all other items required in other specification sections that are to be supplied and installed as part of the Operations Building Industrial Waste Tank.
- F. Contractor shall submit a valid certification from the tank manufacturer showing that the Contractor is a qualified installer trained in accordance with the tanks manufacturer installation requirements and as required for a valid tank warranty.
- G. After installation the contractor shall submit the manufacturer's tank installation checklist properly completed by the Contractor and the Owner's representative to the engineer to verify proper installation of the tank.

#### 1.06 WARRANTY

- A. The Contractor shall be responsible for obtaining the manufacturer's warranty, providing that the system shall be of quality construction, free from defects in material and workmanship.
- B. All equipment, apparatus, and parts furnished shall be warranted for a period of 12 months from the Engineer's Written Acceptance of the work.
- C. Components failing to perform as specified by the Engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the Owner.
- D. The tank shall come with a 30-year manufacturer's warranty.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS:

- A. The storage tank shall be double-walled fiber reinforced plastic as manufactured by Xerxes Corporation, Containment Solutions, Inc., or approved equal.

#### 2.02 UNDERGROUND STORAGE TANK:

- A. Tank shall be manufactured with isophthalic polyester resin and glass fiber reinforcement with no sand fillers. They shall conform to ASTM D3299.
- B. The double-walled tank shall have a space between the inner and outer shell walls to allow for the free flow and containment of all leaked sanitary waste from the primary tank. The space will also allow for insertion of a monitoring device through a monitoring fitting.

C. Tank Dimensions:

1. Tank shall have a nominal capacity of 10,000 gallons.
2. Tank shall have a nominal outside diameter of 8-feet.

D. Tank shall be provided with integrally cast flanges for all pipe connections.

E. Loading Conditions — Tank shall meet the following design criteria:

1. Internal Load — Tank shall be designed to withstand a 5-psig air-pressure test with 5:1 safety factor. Contractor shall test tank for leakage prior to installation. Maximum test pressure is 5 psig.
2. Vacuum Test — Tanks 10'-diameter tank and smaller shall be designed to withstand a vacuum test to 11.5" of mercury.
3. Surface Loads — Tank shall withstand surface H-20 axle loads when properly installed according to tank manufacturers current Installation Manual and Operating Guidelines.
4. External Hydrostatic Pressure — Tank shall be capable of being buried in ground with 7' of overburden over the top of the tank, the hole fully flooded and a safety factor of 5:1 against general buckling.
5. Tank shall support accessory equipment — such as inlet and outlet piping and ladders — when installed according to tank manufacturers current Installation Manual and Operating Guidelines.

F. Product Storage:

1. Tank shall be suitable for storage of vehicle wash water and shall be so certified by the manufacturer. Premium resin that is compatible with the stabilized recreational vehicle waste shall be used to fabricate the inner surface of the tank. The tank lockable watertight cover defined below shall be labeled with the words “Non-Hazardous Industrial Wastewater”. Contractor shall provide a tank suction drop tube with Cam-Lock fitting, 2-inch minimum, to allow a wastewater pump truck to easily connect to the tube in order to empty the tank. Drop tube shall extend to the tank bottom per manufacturer recommendations and to within 12-inches of finished grade. Contractor shall coordinate with the Town on the appropriate size Cam-Lock fitting prior to installation. The inlet drain from the building shall be furnished with a Tee fitting and drop tube per manufacturer recommendations and shall meet the requirements for Schedule 40 PVC Tee fittings which will allow the drop tube to extend down to the bottom of the tank in accordance with manufacturer recommendations and to be cleaned out from grade by accessing the top of the drop tube via a threaded cap, which can easily be removed/installed from grade. All piping to and from the tank shall be bedded in 12-inches of crushed stone all around and rated for H-20 wheel load rating at the necessary buried depth shown on the drawings. Drop tube shall be installed with

a clearance of at least 4 but less than 6 inches between the bottom of the tank and the point at which the regulated substance can first exit the submerged fill tube.

2. Tank shall be vented to atmospheric pressure.
3. Secondary containment shall enclose 360 degrees of the tank that is designed to come into contact with the regulated substance to be contained in the tank.
4. Secondary containment shall allow access without the need for excavation and be protected against unauthorized access and tampering using lockable covers.

## 2.03 TANK ACCESSORIES:

### A. Manways:

1. All manways shall be flanged and 30" I.D., complete with gasket, bolting hardware and lockable cover.
2. Manway locations are shown on EQ series drawing.
3. The Contractor shall extend the tank vent to the adjacent building as per the plumbing drawings, vent shall extend a minimum of 12-feet above finished grade in accordance with manufacturer recommendations. Vent shall be equipped with a vent cap and insect screen per manufacturer recommendations.

### B. Tank Containment Sump/Manhole Assembly:

1. Provide fiberglass reinforced plastic secondary containment collar (42") with fittings and accessories as denoted on the Drawings.

### C. Tank Containment Sump:

1. Containment sump assemblies shall be provided over tank manways. The Drawings show the type, number, size, and location of sump assemblies required for each tank. Each containment sump assembly shall be Fibrelite Standard Plus Model Access Chamber, as manufactured by Fibrelite Corporation of Pawcatuck, CT, OPW, Xerxes, or approved equal.
2. Each containment sump assembly shall be constructed of resin transfer molded composite FRP. Each containment sump assembly shall consist of a composite sump, a composite internal sump lid, and an integrated composite manhole cover, frame and skirt over the sump. Each manhole cover, frame, and skirt shall be sealed to the sump but shall not transfer surface loads from the manhole cover and frame to the sump. Each sump base shall be constructed to facilitate entry of piping and conduit.
3. Each containment sump assembly shall be watertight, with a watertight sump and an integrated watertight manhole cover and frame. Each manhole shall be watertight with an integral seal in the manhole cover to prevent the entry of water when the manhole



cover is in the frame. Each sump shall include a removable reservoir for collecting water entering when manhole cover is removed in wet conditions.

4. Each opening in the sump base, including openings for piping and electrical conduits, shall be provided with entry boots that secure the piping or conduit to the sump base. Each entry boot shall fasten entirely from the inside of the sump, and shall be replaceable entirely from the inside of the sump after the sump is installed in the ground. All entry boot kits shall be third party tested for prolonged exposure to petroleum products. All entry boot kits shall be provided by the sump manufacturer.
5. Each containment sump assembly shall include appropriate fittings, adapters, and bonding agents for watertight installation on the sump collar of the fiberglass tank as shown on the Drawings. The containment sump shall be designed for installation on the tank manway cover without compromising the integrity of the sump assembly.
6. Each containment sump assembly shall be tested at different stages of installation to verify the integrity of the sump assembly, including all piping and conduit entry boots, the tank manway, and the manhole cover and frame assembly. This testing method shall be designed for verifying sump integrity after placing of backfill, and when tank top slab is installed and installation is complete. The sump manufacturer shall provide a testing method that employs instruments and procedures that yield reproducible results that will ensure that sump assembly installation is watertight. The sump manufacturer shall provide a factory-trained technician to test the sump.
7. Tank containment sump size and manhole opening size in tank concrete cover pad shall be such that no vertical point loads are directed onto the containment sump top.

D. Manhole Assembly:

1. Manhole cover, frame, and skirt assemblies shall be provided in the tank top slab over tank openings. The Drawings show number, size, and location of manhole assemblies required for each tank top slab. A locking device shall be provided for each manhole. Each manhole assembly shall be a Fibrelite Composite Manhole, as manufactured by Fibrelite Corporation, or approved equal by OPW or Fairfield Industries.
2. Cover: Each manhole cover and frame shall be suitable for use under HS-20 live loads. Frame and cover system shall be cast into the tank concrete cover pad to prevent transference of surface loads to the sump/UST. Where applicable, each cover shall be provided with a FRP inscription and shall be color-coded to conform to the American Petroleum Institute Color and Symbol Code. The surface resistivity of each cover shall be less than  $1 \times 10^8$  Ohms to prevent the buildup of static charge.
3. Frame: Each manhole frame shall be designed so that the manhole cover will fit securely and not spin in the frame. Each frame shall incorporate a physical water check system to prevent surface water from entering the manhole. The frame shall be of composite FRP, flush mounted to grade and water tight.

4. Skirt: Each manhole shall be constructed of fiberglass and colored to match the cover. The skirt shall extend to within two inches of the manhole cover. Each skirt will be supplied with a stabilizer rod kit for concrete installation. The rod kit shall be made of stainless steel.
5. Handle: Each manhole cover lifting handle shall be provided by the sump manufacturer and formed with 1-1/8-inch stainless steel tubing with alloy casting for the key and a plastic grip. Each handle shall include a foot lever tool and a locking tool. A handle shall be furnished for each individual manhole cover.

E. Gauge and Sensor Manholes:

1. Manufacturer: Fibrelite model 450, 18", square, watertight manholes as manufactured by Fibrelite Corporation, OPW, Fairfield Industries, or approved equal.
2. Manholes shall be equipped with solid bottom skirts, APF color coded, ID bags, a lifting tool for each cover and stainless steel stabilizer kits.
3. Manhole cover and frame shall be suitable for HS-20 live loads. Frame and cover shall be cast into the concrete cover pad to prevent transference of surface loads to the sump/UST.
4. Manhole cover system shall meet same general requirements of the spill containment fill box assembly

F. Wear Plate:

1. Each UST shall have a wear plate under each tank opening to protect the tank bottom from abrasion or puncture with the following requirements:
2. Constructed of steel or glass-fiber-reinforced plastic.
3. Covers an area of at least 144 square inches, centered und the opening.

G. UST Tank Label

1. Each UST shall bear a permanent label such as a stencil or engraved plate that provides the following information:
2. The standard of design by which the tank was manufactured.
3. The year in which the tank was manufactured.
4. The dimensions and capacity of the tank.
5. The name of the manufacturer.

H. Certificate

1. The contractor shall provide a certificate for the owner to maintain at the facility that:
2. Shows all the information required by the UST label described in G. above, the date of installation, and the regulated substances and percentages by volume of any additives that might be stored permanently and compatibly within.
3. Is permanently affixed in such a way as to be visible to a department inspector during a routine inspection.

2.04 MONITORING SYSTEM:

- A. Provide continuous hydrostatic monitoring of interstitial space between inner and outer wall of tank. The monitoring system shall be in compliance with 314 CMR 18.08.
- B. The monitoring system panel shall:
1. Be Model LU3-SP1 by Omntec Mfg. Inc. or approved equal.
  2. Accept a signal from high liquid level switch mounted in the underground storage tank.
  3. Accept a signal from 80 percent full liquid level switch mounted in the underground storage tank.
  4. Accept an underground storage tank leak signal from the reservoir leak and brine reservoir sensor.
  5. Include a test button that will test the entire system electronics from sensors to control panel.
  6. Include an underground storage tank leak "Red" indicating light
  7. Include a tank full level "Amber" indicating light
  8. Include a high water level alarm "Red" indicating light
  9. Include a power is On "Green" indicating light
  10. Include an alarm silence button
  11. Include an annunciator with high intensity strobe and 110 dB horn
  12. Send a general audio and light alarm signal for all tank related alarms to a commonly staffed location within the Operations Building.

13. Require a power supply of 120 VAC, 50/60 Hertz

C. Sensor for Brine Filled Double Wall Tank

1. Sensor shall be non-metallic corrosion-resistant materials.
2. Sensor shall be a dual-point sensor designed for double wall brine filled fiberglass tanks. Sensor shall initiate an alarm when the level in the brine reservoir is beyond acceptable limits.
3. Sensor shall be compatible with the monitoring panel provided.
4. The dual point sensor shall be Model L-R-1 by Omntec Mfg. Inc. or approved equal.

D. Level Sensor

1. Provide two single point ball float level sensors for tank 80 percent full and at the high-level alarm level, 90%.
2. Sensor shall be compatible with the monitoring panel provided.
3. The float level sensor shall be Model L-2 Series two-point liquid level sensor by Omntec Mfg. Inc. or approved equal, sized appropriately for the tank.
4. The level sensors shall be suspended inside the underground storage tank per the tank manufacturer's recommendations and shall be located in a place that is accessible from above.
5. The level sensors and cables shall be designed for submergence in wastewater and shall be sized for operation in and at the specific gravity of the liquid.
6. Due to the nature of the liquid and gases involved in this system, the level sensors shall be intrinsically safe.
7. Cable, conduit and wire that pass through the wall of the tank shall be installed with adjustable, gas-tight and explosion proof conduit wall seals.
8. Wiring shall be in a separate conduit and shall extend back to the alarm panel. No junction boxes will be permitted in the underground storage tank. The Contractor's MA licensed electrician shall be responsible for providing all conduit and wiring necessary to provide power and tank monitoring capabilities as specified in order to provide a complete and operable system.

E. The monitoring system panel shall be enclosed in a UL Listed, NEMA 4X, stainless steel, corrosion resistant, lockable, and waterproof enclosure, rated to take direct spray. The enclosure shall include a visual red common alarm light on the top of the enclosure. The alarm light shall be mounted in such a manner as to maintain the integrity of the

enclosure. The common visual alarm shall annunciate all of the monitoring system panel alarms.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION:

- A. The tank and accessories shall be installed as shown on the drawings and in accordance with the manufacturer's instructions. The Contractor is responsible for obtaining and paying for all permits necessary to install and operate the tight tank system including but not limited to DEP Industrial Wastewater Holding Tank Compliance Certification Form (DEP01) per 314 CMR 18.00.
- B. After initial installation of the tank, the tank installation checklist supplied by the manufacturer must be properly completed by the contractor and the owner's representative. The contractor shall provide the owner and engineer with a copy of the completed checklist to verify proper installation of the tank.

#### 3.02 TESTING:

- A. Tank shall be tested according to the Manufacturer's Installation Manual and Operating Guidelines in effect at time of each installation. Guide Specifications – Filament-wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.
- B. The Engineer shall receive a minimum of 72-hour notice prior to the commencement of any testing.

END OF SECTION

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## SECTION 13 34 43

### FRAME SUPPORTED MEMBRANE STRUCTURE

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specifications, apply to this Section.
- B. The specification is general in nature and scope and shall not be construed as to limit the work; the Contractor shall provide a complete and operable system. The membrane-covered frame salt storage structure shall match the Drawings and Specifications in materials, appearance, configuration and details, as specified herein.
- C. It is the intent of these specifications that the bidder shall include all labor, materials, equipment, services and transportation for the manufacture and supply of the membrane-covered frame structure, including exterior and interior finishes as shown on the Drawings. All buildings shall be as dimensioned with all features and quantities as shown in the Contract Documents.
- D. All workmen shall be skilled and qualified for the work they perform. All materials used, unless otherwise specified, shall be new and of the types and grades specified.
- E. Building manufacturer shall be performed under factory conditions in a plant specifically arranged for this type of work. Manufacturer shall provide all necessary operations for packing and shipping, and provide technical information to the contractor for adequate space planning, equipment and personnel for the assembly and installation of all major components of the building.
- F. The Contractor shall be responsible for obtaining and paying for building permits and approvals as needed to provide a complete and operable system.

##### 1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Design, fabricate, ship, and erect complete frame supported membrane structures, including but not limited to primary framing, supplemental framing for building components (including, but not limited to, lighting and electrical panel), bracing, fabric membrane, gable end louvers, framed openings for louvers, precast concrete block foundation/push wall system, connections to concrete block foundations/walls, and interior wood protection wall as described herein and as shown on the Drawings.

- B. Hot-Dipped Galvanized, Rigid steel frame supporting membrane covered roof and wall structure of the type described herein:
  - 1. The structure must provide a minimum clearance of 13-feet from top of wall within 3-feet of inside edge of foundation. Building must provide an envelope at least 33-feet tall by 22-feet wide in the middle of the building to allow for dumping inside.
  - 2. Flat gable end on both walls with two (2) 3-foot x 3-foot aluminum passive vents or as required by Manufacturer
  - 3. Open end of structure shall be fully open as indicated in the drawings
- C. Related Work: The following items are related to the work of this Section and are specified elsewhere:
  - 1. Section 32 32 16 - Precast Concrete Block
  - 2. Division 0 and 26 Specifications

#### 1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Engineer, design, fabricate and erect the frame supported membrane structure to withstand self-weight, attachment loads and superimposed loads from wind, snow, seismic and to resist in-service use conditions that the building will experience, including exposure to the weather.
  - 1. Engage the services of a Professional Structural Engineer, registered in the State of Massachusetts, to provide the designs required for the work of this Project.
- B. The membrane shall be tensioned over the framework. The interior of the structure below the main trusses shall be clear span free of any structural support members and shall provide unobstructed floor space. No exterior purlins, guy ropes or cables shall be used for anchoring the structure unless approved by the Owner.
- C. Applicable Building Code:
  - 1. International and Massachusetts State Building and Fire Safety Codes – latest edition.
- D. Applicable Design Code:
  - 1. For steel framing: AISC Specification for Structural Steel Buildings. Allowable Stress Design and Plastic Design - 1989.
  - 2. For aluminum framing: SAS 30 Specification for Aluminum Structures.
- E. Building nominal dimensions shall be as shown on the Drawings
- F. The building will be utilized for salt and sand storage.

- G. The structure shall be capable of being assembled, operated and dismantled in all ambient temperatures between -20 °F and 120 °F, and of accepting differential settlement of up to 2.5% between truss positions.
- H. All materials used in the structure shall be new, without defects and free of repairs. The quality of the materials used shall be such that the structure is in conformance with the performance requirements specified herein.
- I. The building shall be designed to accommodate differential settlement as indicated above, the building will be installed on a concrete block foundation as shown on the Drawings. The sway and cross bracing cables shall be adjustable to accommodate differential settlement as needed. In addition, the base plate/mounting hardware for the trusses at the interface with the concrete block wall shall be designed to be raised up by inserting additional plates (or other means) in order to accommodate differential settlement. The adjustable base plate/mounting hardware shall be coordinated with and approved by the Engineer.

#### 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications, details, certified product test results, installation instructions and general recommendations as applicable to building components and the complete building system.
- B. Shop Drawings: Submit drawings consisting of structural framing, steel erection and layout plans, clearance diagrams, framed openings, fabric membrane specifications, block wall foundation design, and other system components and accessories that are not fully detailed or dimensioned in manufacturer's product data. Shop drawings shall be signed and sealed by a Structural Engineer registered in the State of Massachusetts, hired by the contractor, herein referred to as the Structural Engineer.
- C. Membrane Color Samples for color selection: Submit actual samples of membrane (min 12'x12") in the full range of available standard colors for review and selection by the Engineer and the Owner – Approval of the membrane material submission shall not indicate full approval until color samples have been submitted, reviewed and approved.
- D. Anchorage Plans: Submit anchorage plans showing the following:
  - a. Block Wall Foundation overall dimensions
  - b. Anchorage locations
  - c. Anchorage materials and details



- E. Submit any proposed modifications to the foundation layouts and/or dimensions indicated on the Drawings to accommodate the specific requirements of the building manufacturer and/or of the site. The foundation wall/push walls shown on the Contract Drawings are diagrammatic only. The Contractor is responsible for providing additional wall buttresses (quantity and sizes) as required to meet the design criteria included in these documents at no additional cost to the Owner. This requirement will also apply to the need for additional blocks to accommodate changes in grade around the structure foundation. Manufacturer/Supplier shall verify all grades on site and shall coordinate with the General Contractor to accommodate grade changes.

#### 1.05 QUALITY ASSURANCE

##### A. Qualifications:

1. Erector: The erector shall have at least five (5) years' experience of erecting frame supported membrane structures and shall be qualified as follows:
  - a. Authorized in writing by manufacturer qualified to erect their products.
2. Manufacturer: A manufacturer who has regularly engaged in the design and fabrication of frame supported membrane structures under present name for a period of five (5) years minimum with designs by registered engineers in the employment of the building manufacturer.
3. Welder, Tacker and Welding Operation Qualifications: Use welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required.
4. The manufacturer and erector shall maintain a quality control program in general accordance with the AISC Code of Standard Practice.

- B. Design Certification Letter: The design of the structural framing, including connections and anchorage, along with the concrete block wall foundation/push wall system shall be certified by a Professional Structural Engineer, registered in the State of Massachusetts, hired by the contractor (i.e., the Structural Engineer). The Structural Engineer shall submit a design certification letter indicating that the fabric structures and concrete block walls/foundations have been designed as an integrated system and that both the wall/foundation and fabric structure, meet all applicable codes including, but not limited to, the International and Massachusetts State Building and Fire Codes. The wall shall serve as a "push-wall" to facilitate sand and salt loading operations, and shall be designed to not slide or "push- out" during operations.

##### C. Testing and Inspection:

1. Refer to Section 01 45 23 Structural Tests and Inspections for testing requirements which will be administered by the Owner.

#### 1.06 REFERENCES

A. American Institute of Steel Construction:

1. AISC Specifications for Structural Steel for Buildings. Allowable Stress Design and Plastic Design – 1989.
2. AISC S326-78 Design, Fabrication and Erection of Structural Steel Buildings
3. AISC S329-85 Structural Joints Using ASTM A325 or A490 Bolts.

B. American Society for Testing and Materials:

1. ASTM A36 Structural Steel.
2. ASTM A123 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A307 Carbon Steel Externally and Internally Threaded Standard Fasteners.
4. ASTM A325 High-Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
5. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. SAS 30 Specification for Aluminum Structures
7. ASTM A563 A-89 Carbon and Alloy Steel Nuts
8. ASTM A687-89 High-Strength Non-Headed Steel Bolts and Studs

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store materials above the ground surface on platforms, skids, blocking or other supports.
- B. Protect from exposure to conditions that produce rust, or allows dirt or debris to collect on surfaces of framing or fabric membrane.
- C. Handle components such that no parts are bent, broken, or otherwise damaged and avoid damage to other material and work.
- D. The main structural trusses shall be two-dimensional trusses which nest tightly together in order to minimize shipping and storage volume.

1.08 WARRANTY

- A. Manufacturer shall submit applicable warranties and/or certifications for the product to the Owner through the Engineer. Identify available warranties and submit sample of warranties along with Bid.
- B. Manufacturer shall provide a 10 year minimum warranty for the fabric membrane including all attachment hardware, and a 15 year minimum warranty on the steel components of the building.

- C. Include costs for above stated warranty and certificates in the cost of the frame supported membrane structure.

#### 1.09 DESIGN CRITERIA

- A. The building shall occupy the area identified on the Contract Drawings and be placed on top of a precast concrete block wall system as identified on the Contract Drawings.
- B. The structure shall be designed in accordance with appropriate standards using methodology from ASCE 7-98 as an equivalent to SECTION 16 of the International, National, Standard and Uniform Building Codes; using load cases as per Section 2.3 Combining Factored Loads Using Strength Design, when located in the United States.
- C. Primary and secondary framing shall comply with current issues of AISC, AISI and ASTM specifications.
- D. The structure shall meet all applicable codes including the current International and Massachusetts State Building and Fire Safety Codes. In accordance with International and Massachusetts State Building Codes the foundation wall and structure shall support the appropriate roof live load, dead loads, equipment loads, wind load/speed, snow loads, and any other applicable loads/requirements. The following is a summary of the applicable codes. Contractor is responsible for confirming that these loads meet the current International and Massachusetts State Building Code load requirements as applicable:
  - 1. Building Occupancy Category I
    - a. Refer to S000 drawing for loading criteria.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. All materials shall be new, without defects, free of repair, and meet or exceed the physical requirements of the design and fabrication processes.
- B. The manufacturer shall maintain test reports on material inventory from which building components are fabricated.
- C. Structures shall be an arch type system with minimum nominal clearance as identified on the Contract Documents. Structure shall be mounted on the top of the precast blocks to avoid impact with vehicles and shall include all block wall support accessories. All plates and connections shall be hot dipped galvanized. Structure shall include fabric membrane over the top (roof) of the structure and the back wall.
- D. Frame Supported Membrane Structure Manufacturers:
  - 1. Calhoun Superstructures, Iron Horse Structures Authorized Representative, Fran Burke, Phone: (978) 430-6716

2. Legacy Building Solutions, Dynamic Building Systems Authorized Representative,  
David Murphy, Phone: (978) 282-1802
3. RUBB Building Systems
4. Sprung Instant Structures or approved equal

Even though a manufacturer is listed above, they must still be able to provide the fabric structure as indicated in the Contract Documents.

- E. All individual parts or bundles and packages of identical parts are to be clearly marked for identification. The shipping document shall list the description, quantity and piece mark of the various parts, components and elements.
- F. The building system materials shall be delivered to the project site during hours identified in the Contract Documents. Installation contractor will provide adequate workmen and equipment to promptly unload, inspect and accept material delivery.
- G. The installation contractor shall be responsible for unloading, field storage, protection and transfer to the work area of all materials and equipment required to perform the work. At no time shall materials be dropped, thrown or dragged over the transport equipment or the ground.

## 2.02 STRUCTURAL FRAMING

- A. All components of the structural framework shall be fabricated from hot dipped galvanized steel to resist corrosion. The main structure shall consist of welded truss arches with parallel tube chords separated by tube webs (U or C shaped only, round webbing not allowed). Truss sections shall be manufactured and post dip galvanized to ensure proper protection on the inside as well as the external surfaces. Truss shall be manufactured of a cold-formed and induction welded modified grade carbon steel, providing a finished tubular product with exceptional mechanical and corrosion resistant properties. The size of the truss components shall be determined by the Structural Engineer to meet the load requirements identified herein. All dimensional tubing tolerances are in accordance with ASTM 500, Section 10. All steel tubing used in the structure must conform to ASTM A568, ASTM A1011 and G40.21 350W. Finished steel tubing must have the following minimum structural and mechanical properties of ASTM A500/G40.21: Gr. B with minimum yield stress,  $F_y = 42$  ksi and tensile stress,  $F_u = 58$  ksi. All steel flat bar, cross rods and other steel components shall be fabricated and then hot dipped galvanized from material having the minimum structural and mechanical properties of (ASTM 44W): Tensile: 50 KSI and Yield: 44 KSI
- B. Purlin Bracing shall provide for structural stability and to provide for installation of accessory items, the main structural trusses shall be laterally braced by tubular purlins at intervals required by the truss design. All purlin locations shall brace both inner and outer truss chords. To provide for structural stability and to provide for installation of accessory items, the main structural trusses shall be laterally braced by load bearing purlins at intervals required by the truss design.

- C. Wind and Frame Bracing - The structure shall be appropriately stabilized with wind bracing cable as well as any required secondary node restraint assemblies so as to efficiently transfer wind and snow induced stresses to the foundation/anchoring system. Cable diameter for main wind bracing shall be a minimum of 5/16-inch diameter and larger if so required. The structures shall be designed to allow for "X" bracing early during erection to allow for permanent stability of the frame during installation.
- D. Connecting Joints - Connections between primary structural elements shall be designed so as to transfer the compressive and tensile forces present in a given joint. A minimum of Grade 5 bolts shall be used at each truss chord joint. The minimum number of bolts shall be determined by the Structural Engineer to meet the Building Code loading requirements. Primary axial steel, secondary purlins, and end wall frame connections shall be made with a minimum of Grade 5 hex bolts, carriage bolts and self-drilling screws. Connection of truss frame to foundation shall be a pinned type connection to reduce member forces in the truss. Trusses shall be mounted to the top of the precast concrete block walls. Block walls shall be provided with proper support accessories as recommended by the manufacturer to support the structure and the existing grades.
- E. Ancillary Systems - The structure shall be designed to readily accommodate ancillary systems such as lighting, sprinklers, HVAC, insulation systems, etc.
- F. Primary framing shall consist of manufacturer's standard sections to match profile shown in the Contract Documents.
- G. Framing shall consist of hot-rolled steel, fabricated steel truss sections, or extruded aluminum sections.
- H. Bolts for primary framing field connections for steel shall be hot dip galvanized high strength bolts conforming to ASTM A-325. Bolts subject to extreme stress and wear shall be Grade 5 bolts and plated/galvanized or upgraded with JS500 corrosion resistant finish. All bolts shall be installed and securely pre-tensioned so as to prevent change in tightness. Those subject to removal or adjustment shall not be swaged, peened, staked or otherwise installed.
- I. Structural Tubing: Comply with ASTM A 500.
  - J. All structural steel framing and fasteners shall be hot dip galvanized after fabrication per ASTM A123.
  - K. Manufacturer shall provide all components necessary for the foundation/anchoring system and shall provide stamped plans by a Massachusetts Registered Professional Structural Engineer for the foundation/anchoring design.
  - L. All steel tube components, trusses, purlins and fastening tubes shall be coated on the exterior with a corrosion resistant finish material providing a corrosion resistance of 2000 hours tested in accordance with ASTM B 117-90; with a 100% zinc based organic coating applied to the interior.
  - M. Provide all standard manufacturer recommended hardware with the appropriate corrosion protection.

- N. The membrane shall be tensioned with load rated hardware which is plated/hot dip galvanized so as to prevent corrosion. Hardware shall allow full and free rotation at the foundation connection to avoid fatigue failure of threaded assemblies. The membrane shall be tensioned with load-tested tie-down belts. Main and wind bracing cable assemblies shall be manufactured to the required length and press swaged with metal sleeves. The cables are manufactured using preformed galvanized “aircraft” cables, sized with appropriate safety factors. Non-structural fasteners such as wood screws, self-drilling screws, etc., shall be of standard commercial quality.
- O. The Manufacturer and Contractor shall provide supplementary framing as needed to accommodate additional building features including lights and louvers.
- P. The main structural roof trusses shall allow for installation of electrical and mechanical equipment based on collateral loads.

## 2.03 FABRIC MEMBRANE

- A. The membrane shall be UV stabilized, flame retardant coated HDPE fabric meeting Massachusetts State Building Codes for a noncombustible membrane structure or other approved membrane covering. The roof, side walls, end walls and all connecting sections shall be weather tight. In order to provide for a good finished appearance and to ensure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures.
- B. The structure shall be clad with a fire retardant UV stabilized waterproof membrane with a base HDPE material and an LDPE coating, free of defects, manufactured by an approved and reputable supplier with demonstrated long-term performance. Laminated materials are not acceptable for use on the outer weather membrane. The coated membrane fabric shall be waterproof and free from defects. All roofs, end walls and connecting sections shall be weather tight. The material must be UV stabilized and flame retardant, must carry a minimum ten year manufacturer’s warranty on all components of the building including, but not limited to, roof, side, and end walls and must have life expectancy of 15 to 20 years. The minimum fabric specification is as follows:
  1. Minimum Weight: 12.1 oz/sy  $\pm$  5% with minimum base fabric weight, finished thickness, grab tensile strength, tongue tear, cold crack resistance meeting or exceeding Fabreene Industrial Synthetic Fabrics Type P708WW, NovaShield II with ArmorKote Type FRU88X-6, or equal.
  2. Coating Thickness: 3.9 mils average, each side
  3. Finished Thickness: 24 mils (ASTM D-5199)
  4. Grab Tensile Strength: Warp 414 lbf/Weft 446 lbf (ASTM D-751)
  5. Strip Tensile Strength: Warp 468lbf/2in/Weft 504lbf/2in (ASTM D882)
  6. Tongue Tear Strength: Warp 94lbf/Weft 108 lbf (ASTM D-2261)
  7. Flammability Class A (ASTME84-94)
  8. Flame Resistance: 2 sec flameout (NFPA 701)
  9. Flame Spread: 25 or less (ASTM E84)
  10. Acceptable membrane suppliers include: Inertape, Fabrene, Hagihara, or approved

- equal. The membrane manufacturer should demonstrate a minimum of five years successful field experience with provision of polyolefin membrane cladding in use on similar or larger size structures of the type specified herein.
- C. Membrane color shall be determined from all available standard manufacturer's colors. Manufacturer/Supplier shall submit samples of full range of standard colors for review. Manufacturer/Supplier shall not place order for membrane until membrane color has been reviewed and approved by the Engineer and the Owner.
  - D. The membrane shall form a continuous uninterrupted weather tight shell over the framework. In order to provide for a good finished appearance and to insure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures. Horizontal stretch (warp direction) shall be maintained with belting. Vertical stretch (fill direction) shall be maintained with a belt and winch lock system. The membrane shall create a weather tight enclosure.
  - E. The membrane system shall be designed such that adjacent membrane cladding panels can be made weather tight using overlap flaps tensioned the full arc of the truss to the truss base plate. Adjacent membrane cladding covers shall be installed utilizing a belt and winch lock system and be tensioned both vertically and horizontally to prevent wear and abrasion. All membrane welded seams shall attain a minimum strength equal to 70% the membrane material.
  - F. The membrane cladding will be provided with a mechanical tensioning system that allows the membrane to be fully tensioned around the structure perimeter. The system will be designed such that the membrane can be tightly and neatly secured over the structural frame and the systems have a remaining range for adjustment.
  - G. The building design will make allowance for the design tension and seal of the membrane material around doors, ventilation and other openings as well as around the structure perimeter below the main tensioning system and the roof of the existing office building. This seal shall provide a neat and finished appearance and eliminate any loose membrane cladding that could otherwise be damaged by flapping or abrasion. When a membrane

base skirt is required, this shall be supplied and attached at the base perimeter to allow a reasonable seal against air and water intrusion.

- H. The membrane shall not be designed to function as a structural member such that, should any damage to or penetrations of the membrane occur, the integrity of the structural framework would be affected.
- I. The membrane shall be installed to provide a weather tight seal against the foundation wall.
- J. All penetrations shall be flashed per the manufacturer's recommendations for a weather tight system.

#### 2.04 BLOCKWALL/FOUNDATION

- A. The Manufacturer's Structural Engineer shall provide base reactions for foundation design along with a copy of the anchoring requirements, the anchor bolt plan, truss and leg truss line locations.
- B. The final design of the anchor bolt diameters, quantities and embedment lengths are the responsibility of the Manufacturer's Structural Engineer. Any changes required to anchor bolt diameters and quantities must be prior to manufacturing. The building shall be placed on a precast concrete block wall as shown on the drawings. Alternate foundation systems may be proposed by the building manufacturer and will require the stamped approval of the Structural Engineer and shall come at no additional cost to the Owner. The block wall and foundation shall be designed by the Structural Engineer, and the blocks shall meet the requirements of Section 02840 pre-cast concrete block. The inside of the foundation must be treated to inhibit damage to the concrete from the salt and must be completely covered with 23/32-inch pressure treated plywood. The plywood shall be bolted firmly and flush to the top of block wall as approved by the Engineer. All block horizontal joints must be watertight and secured using an adhesive (BASF Sonneborn Premium Adhesive or approved equal) and all vertical joints must be watertight and sealed with weatherproof caulking (BASF Sonolastic NP 1, or approved equal). In addition, the interface between the bottom of the block wall and the pavement shall be sealed to be watertight using a bitumastic sealing compound in accordance with manufacturer's recommendations, and as approved by the Engineer.
- C. Each block in the pre-cast concrete block wall/foundation shall be bolted together on the exterior of the block wall using galvanized steel plating and bolts in accordance with the Structural Engineers recommendation. The plating/bolting of the blocks shall be such that all of the blocks will be bolted/plated together to form one connected foundation/block wall system to allow the wall/building to settle while still maintaining a continuous integrated wall/block system.
- D. The walls shall consist of minimum 4000 psi blocks, 24 inches W x 24 inches H in either 2-foot, 4-foot or 6-foot lengths to create a foundation wall with a minimum of 6 inches



below grade. Blocks shall be formed with an interlocking key system consisting of a minimum of two (2) tapered knobs with minimum dimensions of 2 5/8" high and 7 5/8" diameter. Blocks shall have beveled edges and shall have openings on the bottom sized to interlock with knobs of other blocks when stacked. Blocks shall contain reinforcement as recommended by the manufacturer.

### PART 3 EXECUTION

#### 3.01 INSPECTION

- A. Examine the building interface conditions for conformance with approved anchorage plans. Do not proceed with the work until unsatisfactory conditions have been corrected.

#### 3.02 STRUCTURAL FRAMING

- A. Erect the building structure in accordance with approved erection drawings and instructions.
- B. Provide temporary guys and bracing for squaring, plumbing, and securing the buildings until completion of erection and installation of permanent bracing.
- C. Erection tolerances shall be in accordance with manufacturer's recommendations.

#### 3.03 FABRIC MEMBRANE

- A. Fabric membrane shall be installed in accordance with erection drawings and instructions.

#### 3.04 PROTECTION AND CLEANING

- A. Clean all structural framing and fabric membrane of all dust, dirt and debris.

#### 3.05 CODES

- A. All work to be performed under the conditions of these specifications shall comply with the rules and regulations of all agencies having jurisdiction for this classification of construction, including Building, Fire, Welding, and Safety Codes.

#### 3.06 WELDING

- A. Welding shall be employed only when specified in the original design. Welders qualified and certified to the CSA standard W47.1. Division 2 shall perform welding in accordance with AWS D1.1 and AWS D1.3. All welded components shall be prepared/steel shot blasted prior to the finish coating of hot molten zinc applied to a minimum of 3 mils thick.

#### 3.07 INSTALLATION

- A. Contractor shall provide all equipment, materials, and labor as needed to provide a complete and operable system. All components of the system shall be hot dipped galvanized to prevent corrosion, in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 13 42 00  
PRE-ENGINEERED METAL BUILDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Engineer, furnish and install the following:
  - 1. Designed, pre-engineered and shop fabricated structural steel building frame.
    - a. Shop primed primary, supplemental and miscellaneous metal framing, clips, and accessories with stainless steel screws and fasteners.
    - b. Hot-dipped galvanized (G90) all secondary framing
    - c. Hot dip galvanized (G90) primary, supplemental and miscellaneous metal framing, clips, and accessories
  - 2. Insulated standing seam metal roofing system installed by Licensed Sheet Metal Workers
    - a. Related flashings and running sheet metal work, for all non-specified locations in conjunction with the roofs.
    - b. R-value: 38 minimum (pre-installed).
  - 3. Insulated metal wall panel including brake metal corner, base, jamb, head trim at vertical panels.
    - a. R-value: 30 minimum.
  - 4. Framed openings in walls and roofs.
  - 5. Gutters and downspouts, and metal downspout adapters/transitions.
  - 6. Snow guards.
  - 7. Roof and wall penetration seals.
  - 8. Rooftop curbs for mechanical equipment.
  - 9. Secondary and supplemental steel supports for equipment and work of other sections including but not limited to: Mechanical, electrical and plumbing element.
  - 10. Secondary and supplemental steel supports for equipment and work of other sections including but not limited to: Bridge crane, architectural features, roof hatches, ladders
  - 11. Provide blocking/roof panel support, etc., as needed for roof access ladder specified in Section 05 50 00 – Metal Fabrications.
  - 12. Coordinate for installation of ladder on standing seam metal roof panels.
- B. Furnish the following products to be installed under the designated Sections:
  - 1. Anchor bolts and base plates for placement under Section 03 30 00 – Cast-in-Place Concrete.

## 1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete footings, grade beams and floor slabs.
- B. Section 04 20 00 – Unit Masonry: Concrete unit masonry construction for interior partitions.
- C. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and back-up materials.
- D. Section 08 11 00 – Hollow Metal Doors and Frames: Furnishing and installing hollow metal doors and frames.
- E. Section 08 36 13 – SECTIONAL DOORS: Motorized overhead doors.
- F. Section 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES.
- G. Section 08 91 19 – FIXED LOUVERS: Furnishing and installing fixed and operable louvers and vents.
- H. Section 09 91 00 - PAINTING: Interior finish painting of interior partitions and walls, within the pre-engineered building.
- I. Division 21 - FIRE PROTECTION
- J. Division 22 – PLUMBING.
- K. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Rough-in utilities.
- L. Division 26 - ELECTRICAL: Rough-in utilities.

## 1.03 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
  - 1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
  - 2. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 3. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
  - 4. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
  - 5. ANSI/SDI A250.8 – R2008 (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
  - 6. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
  - 7. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.

8. ASTM A36 - Structural Steel.
  9. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  10. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
  11. ASTM A325 - High Strength Bolts for Structural Steel Joints.
  12. ASTM A386 - Zinc-coating (Hot-Dip) on Assembled Steel Products.
  13. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
  14. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
  15. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  16. ASTM A501 - Hot Formed Welded and Seamless Carbon Steel Structural Tubing.
  17. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
  18. ASTM A529 - Structural Steel with 42,000 psi (290 MPa) Minimum Yield Point.
  19. ASTM A572 - High Strength Low Alloy Columbium Vanadium Steel of Structural Quality.
  20. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  21. AWS A2.0 - Standard Welding Symbols.
  22. AWS D1.1 - Structural Welding Code.
  23. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).
  24. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
  25. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
  26. SSPC - Steel Structures Painting Council.
    - a. Society for Protective Coatings:
      - 1) Surface Preparation Specifications:
        - a) SSPC – SP 1 – Solvent Cleaning.
        - b) SSPC – SP 2 – Hand Tool Cleaning.
        - c) SSPC – SP 3 – Power Tool Cleaning.
      - 2) Surface Preparation Specifications:
        - a) SSPC-PQ 1, Shop, Field and Maintenance Painting.
    - b. Federal Specifications:
      - 1) TT-P-645, Primer, Paint, Zinc-Chromate, Alkyd Type
  27. All applicable federal, state and municipal codes, laws and regulations for exits.
- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. MBMA – Metal Building Systems Manual.
- C. Definitions:

1. Bay Spacing: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).
2. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
3. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
4. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame, or knee).
5. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
6. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
7. Collateral Loads: Dead loads other than those of the metal building system, including, but not limited to: sprinklers, mechanical systems, electrical systems, ceilings and suspended equipment
8. Terminology Standard: Refer to *Metal Building Systems Manual* as published by Metal Building Manufacturer's Association (MBMA) for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
2. Submittal of prefabricated engineered building shop drawings shall be coordinated with submittals for concrete foundations. Concrete foundation shop drawings will not be reviewed until prefabricated engineered building shop drawings have been submitted and approved in order to ensure coordination with foundation construction.
3. Coordination with fall arrest system manufacturer/engineer for load requirements on roof structure and roof panels.

##### B. The metal building system shall be designed by the manufacturer as a complete system. All components of the system shall be supplied by or compatible with the metal building system provided by the manufacturer. The building systems shall be provided from a "single source manufacturer" with all required warranties for the complete building system originating from the single source manufacturer.

##### C. Refer to the Structural Drawings for Design Loads and Design Criteria.

##### D. All design required under this Section shall be performed by a Professional Structural Engineer registered in the State of New York

##### E. Exterior metal wall and roof panel assemblies and supports shall be designed for the specified wind and seismic loads. Refer to Structural Drawings for Design Loads.

1. Roof loading shall include provisions for collateral loading for future solar panels, refer to Structural Drawings.
  2. Roof loading and roof panels shall be designed to accommodate fall protection system directly fastened to standing seams of metal roof panels. Coordinate with fall protection manufacturer/engineer. Provide supplemental steel and/or increase gauge of roof panel as necessary to meet loading requirement at no additional cost to Owner.
- F. Design and provide special framing for the support of architectural features including, but not limited to overhead doors and personnel doors.
- G. Design, detailing and erection shall comply with the applicable standards listed in 29 CFR Part 1926 – “Safety Standards for Steel Erection”.
- H. Sequencing:
1. Field Measurements: Verify that field measurements are as indicated on shop drawings.

## 1.05 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
    - a. Include data on profiles, component dimensions, fasteners, and sealants.
  2. Shop Drawings:
    - a. Shop drawings shall be submitted as a complete package for the entire prefabricated engineered building assembly as described herein. Partial submissions or submissions without a professional engineer's stamp and signature will be rejected.
    - b. Elevations, plans and details: 1/8 inch scale elevations and plans, and large scale design details showing framing, and panel attachment methods (both roof and walls); and complete installation details.
      - 1) Indicate assembly dimensions, locations of structural members, connections, attachments, openings, cambers (if required), and both live and dead design loads.
      - 2) Roof and wall panels: Indicate wall and roof system dimensions, panel layout, construction details, anchorages and method of anchorage, method of installation. Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory-assembled, and field-assembled work.
      - 3) Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
      - 4) Indicate all connections and interface with adjoining work.

- c. Anchor-Bolt Plans: Indicate anchor bolt locations, settings, sizes and material, column base plate dimensions, sizes, etc. and column base reactions at foundation connections. Submit in advance of erection drawings. These are to work for the existing concrete slab and piers that have been installed. See attached drawings in specifications for reference.
  - d. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
  - e. All shop drawings shall be stamped and signed by a professional structural engineer registered in the Commonwealth of Massachusetts.
3. Selection Samples:
- a. Sample card indicating manufacturer's full range of colors available for selection by Engineer.
  - b. Provide additional samples as requested by Engineer for initial selection of colors and finishes.
4. Verification Samples:
- a. 12 by 12 inch samples of roof and wall panels, illustrating material and finish.
    - 1) Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
  - b. Trim and closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
  - c. Vapor retarders: 6 inch (150 mm) square samples.
  - d. Accessories: 12 inch (300 mm) long samples for each type of accessory.
  - e. Sample of R-38 roof insulation assembly.
5. Certificates:
- a. Certificate of compliance from galvanizer: Submit notarized certificate of compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed, zinc coating thickness as specified.
  - b. Shop finished products: Manufacturer's written certification stating that metal building components and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section, and that shop finishing has been performed as specified.
6. Delegated Design Submittals:
- a. Furnish complete design analysis for all structural components of the prefabricated metal building. The structural engineer shall be registered in the Commonwealth of Massachusetts and shall state in writing that the structural framing and building components are in compliance with the criteria set forth in the specifications and as indicated on the Drawings.
  - b. Provide manufacturer load tables indicating the selected panel material, configuration and thickness meets the design requirements for the spans shown
7. Manufacturer's Instructions: Manufacturer's written installation instructions indicating preparation requirements, assembly sequence, special procedures, and field conditions requiring special attention.



8. Source Quality Control Submittals:
    - a. Submit list of installations completed within the last three years, include all contacts and references.
  9. Qualification Submittals:
    - a. Installer/Applicator: Manufacturer's written certification stating that erector is qualified, licensed, authorized and approved to install the building system in accordance with manufacturer's requirements.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00—PROJECT CLOSEOUT.
1. Bonds and Warranty Documentation:
    - a. Manufacturer's warranties and guarantees as specified elsewhere herein this Section.
  2. Record Documentation: Submit accurately record actual locations of concealed utilities.

## 1.06 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: The company manufacturing the products specified in this Section shall have a minimum of five (5) years' experience in the manufacture of steel building systems. The manufacturer shall be certified under the American Institute of Steel Construction's Category MB Certification Program.
  2. Erector: The Erector shall have at least five (5) years' experience of erecting steel building systems and shall be authorized, in writing, by the manufacturer as being trained and qualified to erect their products. The erector shall also be knowledgeable of the AISC "Code of Standard Practice for Steel Buildings and Bridges" and the Metal Building Manufacturer's Association "Metal Building Systems Manual".
  3. Welder, tacker and welding operator qualifications: Use welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform type of work required. Submit verification that welders are AWS D1.1 and D1.4 qualified within the previous 12 months.
  4. The metal building manufacturer and erector shall maintain a quality control program in accordance with the AISC Code of Standard Practice. The erector shall be qualified by the building manufacturer to install and maintain the warranties applicable to this specification. All erectors shall have 10 hour OSHA training and have all personal protection equipment required to perform the work in accordance with all safety requirements and regulations in force.
  5. The roof system shall carry a UL (Underwriters Laboratories) wind uplift resistance classification of 90.
  6. Licensed Professionals: Design Work under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Commonwealth of Massachusetts.
- B. Testing and inspection:

1. Refer to Section 01 45 23 - STRUCTURAL TESTS AND INSPECTIONS and comply with additional requirements specified therein. The inspection and testing services provided by the Independent Testing Agency do not relieve the Contractor from the responsibility to provide supervision, testing, inspection, and quality control in order to assure conformance with requirements specified herein and elsewhere in the Project Manual.

## 1.07 DELIVERY, STORAGE AND HANDLING

### A. Delivery and Acceptance Requirements:

1. Do not fabricate or deliver items to the site, until all specified submittals have been submitted to, and approved by, the Engineer.

### B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
  - a. Stack and cover metal building materials with suitable weather-tight covering.

### C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Engineer specifically authorizes correction thereof and usage on project.

## 1.08 WARRANTY

### A. Manufacturer Warranty:

1. Provide 25-year warranty which shall include coverage for exterior prefinished surfaces to cover prefinished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.

### B. Special Warranty:

1. Provide project specific 20-year unconditional warranty or bond which shall include coverage for weather tightness of roof and wall enclosure after installation.
2. Include costs for the above stated warranties and certificates in the cost of the metal building system.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURER

### A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Ceco Building Systems, Columbus, MS.
2. American Steel Buildings, Murfreesboro, TN.
3. Eagle Steel Buildings, Tyler, TX.

4. Butler Manufacturing Company, Kansas City, MO.
5. MBMI, Inc., Delray Beach, FL
6. Mid-West Steel Building Company, Houston TX.
7. Shenango Steel Buildings, Inc., West Middlesex, PA.
8. Nucor Building Systems, Lancaster, PA.
9. Star Building Systems, Oklahoma City, OK.

## 2.02 PERFORMANCE/DESIGN CRITERIA

- A. Deflection Limits: Exterior wall and roof system to withstand imposed live and wind loads with maximum allowable deflection of span ( $L$  = Span length), refer to Structural Drawings.
- B. Thermal resistance (R-Value): The following listed R-values represent the minimum required insulation value as calculated for continuous insulation coverage over the structure:
  1. Wall system R-value 30 minimum.
  2. Roof system R-value 38 minimum (pre-installed).
- C. Members to withstand progressive snow and live loading, and design loads due to pressure and suction of wind calculated in accordance with Massachusetts State Building Code, Tenth Edition.
  1. Refer to Drawings for design loading.
  2. Underwriters Laboratories (UL) Class 90 rating: The roof system shall carry a UL wind uplift classification Class 90 rating as determined according to UL 580 Tests for Uplift Resistance of Roof Assemblies.
  3. FM Global (Factory Mutual) - The roof system has been tested according to FMRC Standard 4471 and approved as a Class 1 Panel Roof.
  4. Design structural steel sections in accordance with AISC, "Specification for the Design, Fabrication, and Erection of Steel Buildings".
  5. Design light gage cold formed structural members in accordance with latest edition of AISI, "Specifications for the Design of Light Gage Cold Formed Steel Structural Members".
  6. Welding shall comply with AWS Standard No. D1.1.
- D. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to the following temperature ranges:
  1. Ambient temperature range: 120 deg F (67 deg C).
  2. Material surfaces: 180 deg F (100 deg C).
- E. Structural Steel Design: All structural mill sections or welded-up plate sections shall be designed in accordance with the 2005 edition of AISC "Specifications for Structural Steel Buildings", and all cold-formed steel structural members shall be designed in accordance with the 2004 edition of AISI "Specifications for the Design of Cold Formed Steel Structural Members".

## 2.03 DESCRIPTION

- A. General Description:
  1. Clear span rigid frame and roof truss system.

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PRE-ENGINEERED METAL BUILDING

2. Primary Framing: Rigid frame of rafter beams and columns, braced end frames, end wall columns, wind and seismic bracing.
3. Secondary Framing: G90 galvanized, 8 inch nominal cold-formed steel girt framing and roof purlin framing for vertical panel installation.
4. Wall system: Preformed R30, min factory foamed, metal panels of vertical profile.
5. Roof system: Standing seam roof panels, upper and lower layers of insulation, insulated thermal blocking, fabric liner/air and vapor barrier system, and insulation support system.

## 2.04 MATERIALS

### A. Framing:

1. Structural Steel Members: ASTM A36.
2. Structural Tubing: ASTM A500, Grade B.
3. Plate or Bar Stock: ASTM A529.
4. Anchor bolts: ASTM F1554, Gr. 36, Galvanized provided by the General Contractor.
5. High strength bolts, nuts, and washers: ASTM A325, galvanized to ASTM A153.
6. Welding: Comply with AWS D1.1; type required for materials being welded.
7. Primer: Manufacturer's standard gray oxide primer.
8. Grout: Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2,400 psi (17 MPa) in two days and 7,000 psi (48 MPa) in 28 days.
9. Wall girts and roof purlins shall be hot dip galvanized to G90 requirements.

### B. Roof System:

1. General:
  - a. System performance: UL 580, Class 90 rating for wind uplift.
  - b. All panels shall be factory finished on both sides.
2. The roof system shall consist of a standing seam roof panel, thermal blocks, insulation, and an air and vapor barrier, and shall include all clips, closures, sealants, flashing and fasteners as required for a complete and weathertight assembly.
  - a. To establish a standard of quality, design and function desired, Drawings and specifications have been based on the roof system shall be manufactured by MBCI "Superlok" striated panel, 16 inches wide, with a 2 inch mechanical seam. Equivalent products of other manufacturers may be submitted for approval by the Engineer.
  - b. Certification shall be submitted, based on independent laboratory testing, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1680, ASTM E-1646, ASTM E-331 and E-283.
3. Roof Assembly:

- a. Roof Panel: Field-formed, double-lock, standing seam, 16 inch panel width roofing with factory-applied sealant. Minimum panel thickness shall be 24 gage. Base coating shall be hot-dip galvanized per ASTM A653 coating class G-90. Finish coating shall be premium factory-applied fluoropolymer coating as specified herein. Panels shall be of maximum possible lengths to minimize end laps. Provide roof panel manufacturer's roof support clips that allow the entire roof to expand and contract as required by thermal conditions.
- b. Insulation: Provide a complete integrated below purlin vapor barrier and insulation retaining system equal to Guardian Building Products, Solon OH., product: "Guardian Energy Saver FP", (basis of design), Johns Manville, Denver, CO., product: "Simple Saver System", or approved equal. The full depth of the purlin cavity shall be filled with un-faced fiberglass insulation blankets, cut to fit the dimensions between the purlins with a second layer of insulation placed over the top of the purlins running from ridge to eave.  
Total insulation thickness shall be a minimum of 12 inches. Roof panel system shall be installed with thermal blocks over the completed insulation system. Insulation fabric and retaining band system shall be designed as a fall protection system. At the time of installation manufacturer's design and cut sheet shall be submitted as confirmation of the proper design and maximum R-value for the purlin depth indicated. Draped fiberglass blankets with vinyl reinforced polyester film vapor barrier with thermal block shall have a minimum R-value of R-38 (pre-installed).
  - 1) Thermal batt/blanket glass fiber, formaldehyde-free insulation:
    - a) Surface burning characteristics when tested per ASTM E84:
    - b) Flame Spread: 25 or less.
    - c) Smoke Developed: 50 or less.
  - 2) Ceiling fabric: Woven reinforced high-density polyethylene, with outer polyethylene film, conforming with the following requirements:
    - a) Weight per ASTM D 1910: 5 oz./sq. yd. (+/- 10%).
    - b) Tensile Strength per ASTM D 751, Grab: 160 lbs. warp x 145 lbs. weft.
    - c) Tear Strength per ASTM D 751, Tongue: 55 lbs. warp x 50 lbs. weft.
    - d) Moisture Vapor Transmission per ASTM E 96, Method A: 0.015.
    - e) Thickness: 8.0 Mils (+/- 10%).
    - f) Mullen Burst per ASTM D 751: 270 psi.
    - g) Puncture Resistance per ASTM D 4833: 81 lbs.
    - h) Flame Resistance per ASTM E 84: Flame / Smoke: 5/20.
    - i) Flame Resistance per NFPA 701: Pass.
    - j) Sound Absorption per ASTM C 423: NRC Rating 0.70.
    - k) Color from manufacturer's standard range of colors as selected by Engineer.
  - 3) Accessories:
    - a) Steel ceiling straps: Cold rolled steel grade 50 Class I per ASTM A-653-05A.
    - b) Primer: Zinc coated.
    - c) Dimensions: .022 inch thickness by 1 inch wide.
    - d) Color: To match fabric color.

- e) Insulation hangers: Steel hangers supporting insulation between wall girts.
  - f) Fasteners:
  - g) 12-14 TY3  $\frac{3}{4}$  inch self-drilling fasteners with  $\frac{3}{4}$  inch outside diameter washers for light gauge steel purlins.
  - h) 12-24 TY5  $\frac{1}{4}$  inch self-drilling fasteners with banding clips for primary heavy gauge primary framing members.
- 4. Equipment curbs with integral crickets for rooftop mounted mechanical equipment:
  - a. Standard equipment curbing, including but not limited to structural framing members, fasteners, gasketing, crickets, transition and closure pieces, flashing and insulation, as provided by the metal building system manufacturer.
  - b. Materials and finish to match metal roof system.
- 5. Snow guards:
  - a. Acceptable manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
    - 1) Alpine Snow Guards, Morrisville, VT, product: "ASG4025".
    - 2) Sno-Gem McHenry, IL, product: " 2" Gem Clamp with MEC Bracket" Clamp to Seam Snow Retention.
    - 3) TRA Snow & Sun Roof Accessory System, product: "C-2-1-Z Clamp On".
  - b. Snow fence: Aluminum tube and bracket snow guard system, consisting of the following components:
    - 1) Aluminum snow guard brackets with (3) set screws per guard.
    - 2) Aluminum tubing, 1 inch outside diameter and .120 inch wall thickness.
    - 3) 3 inch long internal and concealed couplings.
    - 4) Aluminum ice flags (size, spacing and location as recommended by the manufacturer), end caps and end collars.
    - 5) Finish: Match standing seam roof system.
- C. Wall Systems:
  - 1. General:
    - a. For limits of wall panels and wall panel types refer to Drawings.
  - 2. Insulated Wall Panels (at exterior panel applications):
    - a. System Type: To establish a standard of quality, design and function desired, Drawings and specifications have been based on MBCI or approved equal. Equivalent products of other manufacturers may be submitted for approval by the Engineer.
    - b. **Insulated Wall Panel:**
      - 1) Configuration: Metal panels with concealed fasteners as follows:
        - a) Panel Type WP-1: 42-inch wide, 4 inch thick vertical similar to METL SPAN "CF Striated Wall Panel".

- 2) Minimum metal thickness: 24 gauge exterior face, 26 gauge interior face, galvanized, per ASTM A653, G90.
  - 3) Coatings, exterior.
  - 4) Insulation: Continuous foamed-in-place, non-CFC polyurethane.
  - 5) Panel width shall be 42 inches, panel thickness shall be 4 inches. Insulated wall panels shall have factory applied sealant at the interlocking, thermal break connection. All flashings, support angles, mastics, caulking, and butyl compressive seals shall be installed per the manufacturers required installation manuals. All corners, eaves struts, rakes, and connections that have any voids shall have fiberglass insulation and or foam insulation installed to accomplish a continuous insulation system.
  - 6) Panel length shall be one piece from base of building to top of wall at roof eave and rake lines for vertical panels, unless shown otherwise indicated on the Drawings. For horizontal panels, panels shall be as indicated on the Drawings and no longer than manufacturer's recommendations.
  - 7) Accessories: Furnish and install all accessories as necessary for a complete system including but not limited to, panel closures, inside and outside corners, sill and head trim, roof termination trim, fascias, and soffits.
  - 8) Panel trim materials, including, but not limited to base, jamb, sill, head, corners, butt joints, etc.: Aluminum brake metal.
    - a) All fasteners shall be concealed pre-painted to match the wall color.
- D. Description: Factory prefabricated roof scuttle/hatch unit having a clear opening dimension of 2 feet 6 inches (30 inches) wide by 4 feet 6 inches (54 inches) complying with requirements specified below.
  1. Products which may be incorporated in the work include, but are not limited to, the following
    - a. Babcock-Davis Hatchways, Inc., Arlington, MA. model N°. 6-204.
    - b. Bilco Company, New Haven CT, Model "NB-50".
    - c. Dur-Red Products, Cudahy CA, model "SSH"
    - d. Nystrom Inc., Minneapolis MN, Model "RHA".
    - e. Precision Ladders, model "PSRH-A".
- E. Curb construction: 22 gage galvanized steel liner; 14 gage galvanized steel curb, 12 inches high, containing one-inch thick rigid, high-density fiberboard insulation, and provided with integral cap flashing and 3 inch metal mounting flange.
  1. Integral flashing shall be of same gage and material as the curb.
- F. Cover construction: Sandwich panel construction containing one inch thick glass-fiber insulation with 18 gage galvanized steel exterior panel, and a 22 gage galvanized steel liner.
  1. Performance requirements:
    - a. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m<sup>2</sup>) with a maximum deflection of 1/150th of the span or 20 psf wind uplift.

- b. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  - c. Operation of the cover shall not be affected by temperature.
- 2. Gasketing: Provide mechanically retained, thermoplastic rubber or neoprene gasketing around perimeter of cover.
- G. Hardware: Type 316 stainless steel.
  - 1. Padlock hasps: Provide interior and exterior of curb.
  - 2. Hinges: Heavy pintle hinges.
  - 3. Operator: Compression spring operators enclosed in telescopic tubes to provide controlled door operation throughout the entire arc of opening and closing.
  - 4. Hold open and handles: Automatic hold-open and operating arm with vinyl grip handle on interior of cover.
- H. Hatch railing system: Complies with OSHA 29 CFR 1910.23 and OSHA strength requirements.
  - 1. Posts and rails: 1-1/4" diameter aluminum alloy 6061 T6 schedule 40 pipe.
  - 2. Curb mounting brackets and teardrop brackets are aluminum extrusions. Locking mechanism is cast aluminum and spring hinges and all fasteners are type 316 stainless steel.
  - 3. Hatch railing powder coat finish shall be safety yellow\* powder coat paint finish.
  - 4. Warranty: Furnish a 5-year manufacturer's warranty against defects in material and workmanship.
- I. Fabricate components free of visual distortion or defects. Scuttle operation shall be unaffected by temperature. Weld corners and joints. Provide for removal of condensation occurring within components of assembly. Fit components for weathertight assembly.
- J. Factory finish: Red oxide primer on steel.
- K. Factory finish: PVDF painted color from manufacturer's options.

## 2.05 ACCESSORIES

- A. Roof Supplemental Steel: Provide structural framing for support of supported equipment's and suspended equipment or wall systems framing into roof purlins as indicated on the Drawings.
- B. Framed Openings: Provide structural framing for roof and wall openings to accommodate roof curbs, overhead doors, personnel doors, windows, and louvers.
  - 1. Wall and roof openings shall be trimmed out and made weather tight by the Contractor. The Manufacturer shall supply trim components.



2. Hot dip galvanize structural steel channels and tubes at overhead doors, personnel doors and all other locations where secondary framing is in contact with base slab at exterior perimeter of the building.
- C. Gutters and Downspouts: Manufacturer's standard including all offsets and 90-degree bends for downspouts. Gutters and downspouts shall be made from galvanized steel class G90. The Engineer shall select finish colors.
1. Downspout transition boot: Factory finished, 11 gauge, custom color to match downspout equal to Piedmont Pipe "Type SO".
- D. Wall and Roof Penetrations: Manufacturer's standard offering to cut and seal wall and roof openings for miscellaneous flues, plumbing and electrical penetrations:
1. Contractor to coordinate roof openings, vents, plumbing and electrical penetrations with mechanical, plumbing and electrical drawings.
  2. Roof penetrations shall not penetrate the standing seam of roof panels.
- E. Roof openings shall be cut and sealed by the Contractor. Insulated roof curbs shall be supplied, installed and made weathertight by the Contractor. Sizes to be coordinated with mechanical drawings.
1. Roof curb installation shall be panel over curb flange on high side and panel under curb flange on low side.
  2. Roof curbs to have a cricket on the high side. All roof penetrations shall be provided and installed by the Contractor and shall be incorporated in the weather-tightness warranty by the building manufacturer and the Contractor.
- F. Louvers: Coordinate with Specification Section 08 91 19 – FIXED LOUVERS.
- G. Snow Guards: Mechanically fastened to standing seams of metal roofing in two rows with spacing per manufacturer's recommendations or as indicated on the Drawings.
- H. Accessories, including but limited to, roof curbs, sill angles, panel base metal closures, flashings, soffits, eave trim, gable trim, door side flashing, header flashing, fascia's and trim, shall be the manufacturer's standard offering and be made of galvanized steel class G90. Finish coatings shall be the same as the roof panels. Colors shall be selected by the Engineer.

## 2.06 FINISHES

- A. Primary, secondary and supplemental structural steel.
1. Typical: Shop prime all steel components as specified herein.
  2. Wash Bat: Hot dip galvanize all steel components.
  3. Secondary Steel: Hot dip galvanize all steel components.
- B. Exterior face sheet of insulated and uninsulated metal panel components and accessories, and exterior and interior faces of roof components and accessories: Pre-coated finish on galvanized coated (G90) steel.
1. Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
    - a. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".

- b. Finish coating shall be manufactured as one of the following products:
    - 1) Morton International; product "Fluoroceram"
    - 2) PPG Industries Inc.; product "Duranar."
    - 3) Valspar Corp., product: "Fluropon."
  - c. Prepare and prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
  - d. Shop finish exterior wall panel surfaces and both sides of roof panels with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.
    - 1) On reverse side of exterior face sheet of insulated wall panels provide off-white washcoat.
  - e. Color and Appearance: Color shall be selected by Engineer from paint manufacturer's full range of colors (including metallic). The available library of all colors shall not be less than 16 colors. Two colors for panels shall be selected by the Engineer.
- C. Interior face sheet of insulated metal panel components and accessories: Manufacturer's standard two coat polyester system on the exposed side and 0.30 mil (minimum) non-color controlled wash coat primer on unexposed side.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
  - 1. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.
  - 2. Beginning of installation means acceptance of existing substrate and project conditions.

#### 3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC Specification.
  - 1. Bolt settings and other dimensions shall be held to a tolerance of plus or minus 3 mm (1/8-inch). Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise indicated on approved shop drawings.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated on approved shop drawings.
- C. Set column base plates with non-shrink grout to uniform full plate bearing and to maintain established floor line elevation(s).
- D. Do not field cut or alter structural members without approval of Engineer.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

### 3.03 ERECTION - WALL AND ROOFING SYSTEMS

- A. Roof and wall coverings shall be installed in accordance with erection drawings and in strict adherence to manufacturer's instructions. Install all gaskets, joint fillers, seals, and flashing where indicated for weatherproof performance of the panel systems.
  - 1. Connect roof panels to purlins with concealed clips in accordance with manufacturer instructions.
  - 2. Wall panels shall be continuous from wall base to roof, unless detailed otherwise on the Architectural Drawings.
- B. Install sill angle, trim and closures to provide a weather/draft tight seal between the sill angle and top of concrete and at wall and roof panel interfaces
- C. Install in accordance with manufacturer's instructions.
- D. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- E. Fasten cladding system to structural supports, aligned level and plumb.
- F. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing, all side laps will be at least one full corrugation. Seal all panel side and end laps with manufacturer's recommended weather sealing compound to prevent the entry of capillary moisture.
- G. Use concealed fasteners to the greatest extent possible. Exterior exposed fasteners shall be permitted only where indicated on approved shop drawings.
- H. Install insulation as indicated on approved shop drawings. At unsupported areas, place wire mesh under vinyl for support between framing members.
- I. Install sealant and gaskets to prevent weather penetration.
- J. System: Free of rattles, noise due to thermal movement and wind whistles.

### 3.04 INSTALLATION ACCESSORIES

- A. Seal wall and roof accessories watertight and weather tight with sealant, in accordance with requirements of Section 07 92 00 – JOINT SEALANTS.

### 3.05 INTERFACE WITH OTHER WORK

- A. Coordinate work with door frames, overhead door, glazed openings in accordance with respective product manufacturer requirements and as specified under related specification sections. Ensure work of this Section permits proper interface and installation of products installed into metal building systems work.

### 3.06 TOLERANCES

- A. Framing Members, maximum variation from plumb or level: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

- B. Siding and Roofing, maximum offset: 1/8 inch (3 mm) from true position

### 3.07 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Clean work under provisions of Section 01 74 13 – CLEANING UP.

### 3.08 PROTECTION

- A. Protect finished work under provisions of Section 01 52 13 - TEMPORARY FACILITIES.

### 3.09 INDEPENDENT TESTING AGENCY COORDINATION

- A. Coordinate with Owner, General Contractor, and Independent Testing Agency.

END OF SECTION

## SECTION 14 22 13

### CRANE SYSTEMS

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED:

- A. This section of the specifications covers furnishing and installation of one (1) single girder underhung electrically operated bridge crane.
- B. The bridge crane shall be of the specified span and capacity, complete with end trucks, bridge girder, bridge control panel, motors, inverter bridge drive to provide two-step infinitely variable speed, wiring, electrification, festooned eight-button push button station, radio control, and warning strobe.

##### 1.02 RELATED WORK:

- A. Section 13 42 00, PRE-ENGINEERED METAL BUILDING
- B. Section 09 91 00, PAINTING
- C. Section 12 40 00, EQUIPMENT FURNISHING AND ACCESSORIES
- D. Division 26, ELECTRICAL (power connections only)

##### 1.03 REFERENCES

- A. American National Standards Institute (ANSI)
  - 1. B30.20-1967, Safety Code for Overhead and Gantry Cranes
  - 2. C1, National Electric Code
- B. American Welding Society (AWS) D14.1, Specifications for Welding Industrial and Mill Cranes
- C. Crane Manufacturers' Association of America (CMAA):
  - 1. CMAA Specification No. 61, Clearance from Obstruction
  - 2. CMAA Specification No. 74 Specifications for Underhung Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes
- D. Occupational Safety and Health Administration (OSHA), 29 CFR 1910, Subpart 179, Overhead and Gantry Cranes
- E. National Association of Electrical Manufacturers (NEMA)

F. National Electric Code (NEC)

G. Massachusetts OSHA

H. Massachusetts Building Code

1.04 QUALITY ASSURANCE:

- A. Overhead cranes shall be designed, manufactured, assembled, and shop tested by a single manufacturer in strict accordance with CMAA standards.
- B. Manufacturer shall be a reputable firm able to demonstrate a minimum of five years' experience in design, manufacture, and assembly of cranes.
- C. Certify that the design and installation of the cranes comply with Seismic criteria in accordance with the Massachusetts Building Code.
- D. The Contractor shall guarantee that the components furnished are compatible and that the completed crane system shall be satisfactory and operational in all locations.

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six sets of complete shop drawings shall be submitted to the Engineer for review prior to the fabrication or manufacturing of any equipment.
- B. Three sets of complete operation and maintenance manuals shall be submitted upon installation.
- C. Crane drawings and certification stamped by a registered Massachusetts Structural Engineer.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Acceptable Manufacturers:

- 1. Mass Crane and Hoist, 72 Progress Ave., Tyngsboro MA 800-909-2299
- 2. Ace Industries, Inc., 6295 McDonough Dr., Norcross, GA 30093, 800-733-2231
- 3. L.K. Goodwin, 890 Broad St., Providence, RI 800-343-2478
- 4. These Specifications are not designed to limit the competition or to limit the equipment to any specific bidder. The specifications listed are minimum and must be met or exceeded. Additional acceptable manufacturers able to meet the specified requirements and quality may be approved by the Engineer.

- B. Contractor shall be responsible for notification to, and coordination with other trades. If the equipment provided differed from that specified herein, Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment at no additional cost to the Owner.
- C. All equipment shall be new and of first-class commercial grade, of the latest approved design. Construction, workmanship, and material must be the best quality, free from defects which would render it unsuitable or ineffective for the purpose for which it is to be used. Any fault due to defective design, material or workmanship which may develop shall be made good by, and at the expense of, the Contractor.
- D. All electrical equipment shall operate on 460 Volt, 3-phase power
- E. Girders to be designed in accordance with CMAA Specification No. 74.
- F. All equipment shall conform to provisions of the National Electric Code and the latest specifications of the Crane Manufacturers Association of America (CMAA).
- G. Each hoist shall be equipped with an electro-mechanical load limiting device that shall prevent lifting more than 110% of the rated load.
- H. All materials shall be shop painted in accordance with manufacturers' standards. All field painting shall be by the crane manufacturer in accordance with Section 09 91 00 Painting.
- I. Paint: Bridge Cranes and hoists shall be painted safety yellow with the rated load painted clearly in black paint.

## 2.02 5-TON UNDERHUNG CRANE (MA-1)

- A. Crane shall be classified as CMAA Class C.
- B. The 5-ton underhung crane shall consist of a single underhung girder and a structural runway with a festoon system. The crane shall have a maximized lifting height as shown on the Drawings (minimum of 20'-0"). Underhung girder and structural runway dimensions shall be based on the limits identified on the Contract Documents.
- C. The Contractor shall support the bridge crane from the roof primary framing members at the column lines as indicated on the Drawings. The Contractor shall be responsible for supporting the crane from the framing members indicated in accordance with manufacturer requirements, in order to provide a complete and operable system, and shall determine the exact number of supports in accordance with the manufacturer's requirements for the rated loading of the crane. Crane clearance over the mezzanine shall be maximized. Contractor shall submit a stamped design certification letter for the crane supports, girder, runway and other crane components from a registered structural engineer in the State of Massachusetts, indicating that the crane is properly connected/supported to the roof framing members for the cranes' rated capacity.

- D. Hoist to include 5-ton capacity R&M wire rope hoist, two speed (19/3.2 FPM) motor.
- E. Trolley to be operated by a 65 FPM VFD motor.
- F. Bridge to be operated by a 100 FPM VFD motor. Bridge controls to be push button, festooned across the bridge on a separate track.
- G. Deflection of the rail shall be limited to a maximum of 1/450 (vertical) and 1/400 (horizontal) of the span.
- H. All supporting details shall be fabricated of structural steel, plate or forgings only. No castings will be permitted. System shall be suspended using components supplied by the crane manufacturer or approved equal.
- I. The rated load of the crane shall be the maximum load for which the crane is designed and built by the manufacturer. In determining the rated load, all handling devices such as buckets, magnets, grabs, etc., shall be included as part of the load to be handled.

2.03 5-TON UNDERHUNG CRANE ELECTRIFICATION:

- A. Power shall be supplied by means of enclosed rigid type contact conductors mounted parallel to the track. Conductors shall comply with the provisions of Article 610, ANSI CI National Electric Code.
- B. Capacity of contact conductors shall be sized to carry the required current to the hoist when operating with the rated load minimum, 50 amp mainline disconnect consisting of a combination circuit breaker (50,000 AIC) and non-reversing starter, starter without overloads (mainline contactor) in NEMA Type 4 enclosure shall be provided. Mainline disconnect shall be equipped with energy isolating devices designed to accept lockout devices.
- C. Electrical enclosures to be NEMA 4 enclosures, unless otherwise indicated.
- D. Provide electrical transformer, sized to system, to step down voltages for the required controls and accessories.
- E. Collectors shall be of the wheel or shoe type and shall be designed to reduce to a minimum sparking between the wheel or shoe and the contact conductor. Conductors shall carry the seal of Underwriters' Laboratories.
- F. Disconnect and power feeds shall be in accordance with Division 26, ELECTRICAL.



## 2.04 5-TON UNDERHUNG CRANE CONTROLS:

- A. Crane controls to be designed such that operator will be safely away from lifting load. Emergency safety stops to be provided locally at the crane motor and via remote control.
- B. Push button controls and cable assembly shall be suspended from an independent festoon track. The pushbutton station shall have a NEMA4 rating with the following features: bright yellow polypropylene enclosure for easy visibility, 8-button enclosure, momentary on/off, six each 2-speed buttons, double break silver-plated switch contacts, multi-grip cord grip accepts eight through 24 conductor round cable, strain relief cable and fittings, easy to read legend plates, replaceable neoprene boots, neoprene bushing, and warning tag.
- C. Push button festooning shall carry control wiring from the independently suspended push button station to the control panel. Push button festooning shall be a rugged steel C track system with trolleys, NEMA12 junction box, flat cable, and all other components required to control the 2-step bridge control panel, the 2-speed hoist, and the 2-stop trolley.
- D. Radio controls shall have safety features that include receiver self-diagnosing, transmitter self-diagnosing, transmitter low voltage detection and warning, transmitter and receiver MAIN deactivation when the transmitter is not in use, during transmitter low voltage, and when the system is in sleep mode. The encoder/decoder system shall utilize advanced microprocessor control. If the receiver MAIN relay is defective (fails to open or close during operation), the safety relays shall signal the system to shut-down immediately to avoid the possibility of any accidents occurring. Synthesized PLL receiving module shall accept signals from 30 available channels. Transmitter and receiver enclosures shall be fully waterproofed and also be impervious to dust, water, oil, grease, acid, alkaline, heat, and sunlight.
- E. Remote controller unit shall operate via rechargeable battery. Equipment supplier to provide the following:
  - 1. Battery backups to cover power requirements for three full shifts of operation
  - 2. Battery charger unit and/or cords
- F. Crane mounted controls shall be enclosed in NEMA 4 enclosures, pre-wired and tested prior to shipment, unless otherwise noted.
- G. Provide electrical transformer, sized to system, to step down voltages for the required controls and accessories.
- H. Disconnect and power feeds shall be in accordance with Division 26 Electrical and as shown on the Electrical Drawings.

## 2.05 CERTIFICATION:

- A. Provide certification of all factory tests, including, but not limited to:
  - a. Electric wire rope hoist testing
  - b. Crane hook non-destructive testing
  - c. Safety features such as limit switches and emergency stops
  - d. Power supply and electrical components
  - e. Massachusetts Structural Professional Engineer Certification

## PART 3 - EXECUTION

### 3.01 INSTALLATION/TESTING:

- A. Transportation, installation, start-up, and full scale load test to be included under this section.
- B. Leveling and bracing per CMAA code.
- C. At the conclusion of the installation, the Contractor shall demonstrate the ability of the equipment to handle the required capacity load smoothly and easily.
- D. Equipment supplier to provide up to four hours of training on the operation and maintenance of the crane system at no additional cost to the Owner.
- E. All cranes shall come with a minimum one year warranty beginning. The Contractor shall perform all necessary repairs and replace equipment if needed during the one year period at no additional cost to the Owner.
- F. The general components of the system only are described above and shown on the drawings and not all components are specified. The Contractor shall provide all equipment, materials, and labor necessary for a complete, operable, and code compliant system in accordance with the manufacturer's recommendations. The Crane hoist/bridge/runway motor horsepower ratings shall be modified as needed at no additional cost to meet the above performance requirements.
- G. All electrical work for this section shall be provided by a Massachusetts Licensed Electrician.

### 3.02 TRAINING

- A. The Crane Manufacturer shall provide training for up to twenty (20) Town employees to help them obtain their Massachusetts Hoisting License in order for them to be able to operate the crane. The training class shall include a training DVD, a safety program and manuals. Following the training the Town employees shall have received all required credentials to apply for and secure their Hoisting License from the State of Massachusetts.

END OF SECTION

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Crane Systems.docx

## SECTION 14 45 00

### VEHICLE LIFTS

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED:

This section of the specifications covers furnishing and installing vehicle and equipment lifts, as indicated on the plans and herein.

##### 1.02 RELATED WORK:

- A. Division 3, CONCRETE
- B. Division 22, PLUMBING
- C. Division 26, ELECTRICAL

##### 1.03 REFERENCES:

- A. Automotive Lift Institute (ALI) 2015 standards
- B. Occupational Safety and Health Administration (OSHA) requirements
- C. UL-201, Standard for safety of garage equipment

##### 1.03 QUALITY ASSURANCE:

- A. Vehicle and equipment lifts shall be designed, manufactured, assembled, and shop tested by a single manufacturer. All lifts supplied for project shall be by a single manufacturer.
- B. Manufacturer shall be a reputable firm able to demonstrate a minimum of five years' experience in design, manufacture, and assembly of vehicle and equipment lifts.
- C. The Contractor shall guarantee that the components furnished are compatible and that the completed system shall be satisfactory and operational in all locations.

##### 1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

- A. Six (6) sets of complete shop drawings shall be submitted to the Engineer for review prior to the fabrication or manufacturing of any equipment.
- B. Provide electrical, structural, and dimensional requirements prior to the fabrication and manufacturing of any equipment.
- C. Provide manufacturer requirements for drain location and floor slopes to drains within pits of flush mounted platform lift for engineer review. Provisions for preventing ponding within the pits shall be included.
- D. Three (3) sets of complete operation and maintenance manuals shall be submitted after

the shop drawings have been reviewed.

## PART 2 – PRODUCTS

### 2.01 EQUIPMENT:

#### A. GENERAL:

1. These specifications are not designed to limit the competition or to limit the equipment to any specific bidder. The specifications listed are minimum and must be met or exceeded.
2. Contractor shall be responsible for notification to, and coordination with, other trades. If the equipment provided differs from that specified herein, Contractor shall provide all relevant data and requirements (e.g., power, structural) required by other trades for installation and operation of the equipment at no additional cost to the Owner.
3. Concrete floor requirements – General Contractor to verify with supplier prior to installation of concrete floor.
4. All lifts shall be 3rd party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts meet conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV and in compliance with IBC chapter 30.
5. Contractor shall coordinate utility requirements for approved equipment with subcontractors to ensure proper services and utilities are provided for approved equipment. Contractor is responsible for providing alternate services for approved equipment at no additional cost to the owner.

#### B. 18,000LB. MOBILE COLUMN LIFTS (MB-1)

1. General: The intent of this specification is to establish the minimum standards of quality and performance for portable mobile column lifts which will be used to lift a variety of vehicles including Trucks, Buses, Passenger Vehicles, Forklifts and other general service vehicles. This specification shall describe a mobile column surface mounted, wheel engaging lifting system designed to elevate vehicles for the purpose of inspection and maintenance.
2. 20,000 lb (9072 kg) Capacity HD Symmetric Two-Post Lift, AC Powered:
  - a. Basis of Design: Rotary Lift, Model MCHW18, or other approved equal.
  - b. Capacity: 18,800 lbs. (8,528 kg) per column, 6 Mobile Columns = 112,800 lbs (51,165 kg)
  - c. Lifting Fork Length: 14 inches (356 mm) forks accommodate rim sizes 9 inches (229 mm) minimum to 24-1/2 inches (622 mm) maximum.

- d. Floor requirements: 4-1/2 inches thick (minimum) 3000 psi concrete not to exceed a side to side floor slope of 1/8 inch = 1 foot 0 inches and not to exceed a 1/4 inch = 1 foot 0 inches floor slope fore and aft.
- e. Motor: 3kw, 24 volt minimum.
- f. Hydraulic Tank Capacity: 10.5 quarts (10 liters) mobile columns will require 11-1/2 quarts (11 liters) of fluid to fill tank, hoses, and cylinders. Bio-Fluid compatible.
- g. Overall Height at Full Lower: 102 inches (2591 mm).
- h. Overall Height at Full Rise: 144-3/8 inches (3677 mm).
- i. Overall Width: 45-1/2 inches (1156 mm).
- j. Overall Length: 48-9/16 inches (1234 mm).
- k. Turning Radius: 45 inches (1143 mm).
- l. Rise: 70 inches (1778 mm).
- m. Lifting/Lowering Speed: 78 seconds to full rise - 54 seconds to fully lowered position.
- n. Control Voltage: 24 volts DC. Rechargeable by 110 Volt Automatic Weather Tight Marine Charger.
- o. Hydraulic System: Each lifting unit shall be equipped with an electric hydraulic power unit, consisting of a DC motor, gear pump, reservoir, check valve, pressure relief valve, and two control valves. Entire power unit totally enclosed to protect from dirt and water.

#### C. 20,000LB. TWO-POST LIFT (MB-2)

- 1. General: Surface mounted, frame contact, two-post mechanical vehicle lifting devices configured to provide wheels-free under carriage service access by engaging vehicle pick-up points, with symmetrical lifting arms centered on vehicle.
- 2. 20,000 lb (9072 kg) Capacity HD Symmetric Two-Post Lift, AC Powered:
  - a. Basis of Design: Rotary Lift, Model SPO20, or other approved equal.
  - b. Minimum Bay Size: 15 by 30 feet (4572 by 9144 mm).
  - c. Overhead Clearance Required: Standard 16 ft (4877 mm)
  - d. Overall Width: 166 inches (4216 mm).
  - e. Rise: 72 inches (1828 mm).
  - f. Drive-Through Width: 126 inches (3200 mm).
  - g. Lifting Arm and Adapter Configuration: 5 and 10 inch (127 and 254 mm) screw up adapters.
  - h. Motor: 4 HP single phase.
  - i. Controls: Single point manual.
  - j. Manual Lock-Release Electric Power Unit: Over hydraulic cylinder; UL 201; bio hydraulic fluid compatible.
  - k. Electrical Requirements: 208-230VAC [single phase]
  - l. Full Rise: 65 seconds.
  - m. Color: As selected from manufacturer's standard colors.

## PART 3 - EXECUTION

### 3.01. INSTALLATION/TESTING:

A. Contractor to coordinate with other trades to insure safe and proper operation of equipment, including:

1. Structural/concrete
2. Electrical

B. Contractor shall submit vehicle lift system to the Engineer for approval prior to installing garage concrete floor or providing electrical and compressed air service for the lift system, and shall ensure vehicle pit dimensions and utility requirements are properly coordinated prior to installation.

3.02 The Contractor shall submit vehicle lift system to the Engineer for approval prior to installing garage concrete floor and prior to providing electrical and compressed air service for the lift system, and shall ensure pit dimensions and utility requirements are properly coordinated prior to installation.

3.03 For all lifting systems the Contractor shall coordinate work with the electrical and plumbing drawings.

3.04 All vehicle lifts shall be installed and tested in accordance with ALI requirements, and the lift manufacturer shall submit that this has been performed.

END OF SECTION

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## SECTION 21 00 50

### BASIC FIRE SUPPRESSION REQUIREMENTS (FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 – GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 SUMMARY:

- A. The work of Division 21 is governed by the General and Supplementary Conditions of the Contract, and Sections of Division 1 of the Project Manual.
- B. Perform work and provide materials and equipment as shown on Drawings and as specified or referenced in this Section of the Specifications. Completely coordinate the work of this Section with work of other trades and provide complete and fully functional systems installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and backcharges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the Contract Documents.
- D. Section Includes: The work of this Section includes the basic requirements common to the Fire Protection Sections of Division 21, including:
  - 1. Definitions.
  - 2. Organization of submittals.
  - 3. Proposed substitutions.
  - 4. Coordination drawings.
  - 5. Warranty.



6. Manuals and Instructions.
7. Record documents.
8. Sleeves and penetrations.
9. Valve tags.
10. Equipment and piping identification.
11. Pressure Vessels.
12. Access Panels.
13. Motor Requirements.
14. Removal Work.
15. Core drilling.
16. Cutting and Patching.
17. Fire Watch.
18. Scaffolding, hoisting, rigging and staging.
19. Systems start-ups.

E. Related Sections: Related work specified in other Sections includes, but is not necessarily limited to:

1. Section 01 52 13 - Temporary Facilities and Controls: Temporary heat, light, power, fire protection, and sanitary facilities for use during construction.
2. Section 01 73 29 - Cutting and Patching: Openings in masonry, concrete, tile, and other parts of structure, except drilling for hangers, providing holes and openings in metal decks, and core drilling.
3. Section 02 41 19 - Selective Demolition: Removal and disposal of demolished mechanical and electrical piping and conduit systems and equipment.

4. Section 03 30 00 – Miscellaneous Cast-in-Place Concrete: Housekeeping pads and inertia pads.
5. Section 05 50 00 - Metal Fabrications: Structural supports necessary to distribute loading from equipment to roof, floor, walls or other building structural components.
6. Section 07 62 00 - Sheet Metal Flashing and Trim.
7. Section 07 84 13 – Penetrations and Fire Stopping: Caulking of pipe and duct penetrations through floor slabs and fire-rated or smoke partitions.
8. Section 08 31 15 - Access Doors and Frames: Access to concealed mechanical, electrical, and telecommunications devices.
9. Section 09 51 00 - Acoustical Ceilings: Removal of existing ceilings for new work under Divisions 15 and 16.
10. Section 09 91 23 – Interior Painting: Painting of exposed piping and equipment except as specified in this Section.
11. Division 21 - Fire Suppression.
12. Division 22 – Plumbing.
13. Division 23 - HVAC
14. Division 26 - Electrical.
15. Division 27 – Communications.
16. Division 31 – Earthwork.
17. Division 30 – Utilities.

### 1.3 REFERENCES:

#### A. American National Standards Institute (ANSI)

1. ANSI A13.1 - Scheme for the Identification of piping systems.

#### B. American Society of Mechanical Engineers (ASME)

1. ASME 2019 Boiler and Pressure Vessel code Section VIII, Rules for Construction of Pressure Vessels.

- C. American Society for Testing and Materials International (ASTM)
  - 1. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
  - 2. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops.
- D. Compressed Gas Association (CGA)
  - 1. C-9 - Standard Color Marking of Compressed Gas Cylinders Intended for Medical Use.
- E. Construction Specifications Institute. (CSI)
  - 1. Manual of Practice
- F. Underwriters Laboratories (UL)
  - 1. Fire Resistance Directory, Vol. I - Beams, Columns, Floors, Roofs, Walls, and Partitions.
  - 2. Fire Resistance Directory, Vol. II, Through Penetration Firestop Systems.
  - 3. ANSI/UL1479 - Fire Tests of Through Penetration Firestops.
- G. National Fire Protection Association
  - 1. No. 241-Safeguarding Construction, Alteration, and Demolition Operations.
- H. Code of Massachusetts Regulations (CMR)
  - 1. 248 CMR Massachusetts State Fuel Gas and Plumbing Code.
  - 2. 522 CMR Massachusetts Board of Boiler Rules
  - 3. 527 CMR Massachusetts Board of Fire Protection Regulations.
  - 4. 780 CMR Massachusetts State Building Code.

#### 1.4 DEFINITIONS:

- A. General: Words and terminology used throughout the Fire Protection Sections of Division 21 shall be understood in their common usage as defined in a common dictionary, and as further defined in the CSI Manual of Practice, the General and

Supplemental Conditions of the Contract, Division 1 of the Project Manual, and the Sections of Division 21.

- B. Specification Content: The Fire Protection Specification Sections in Division 21 may use certain conventions regarding the style 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:
1. Abbreviated Language: Language used in Specifications and other Contract Documents maybe of the abbreviated style. Words and meanings shall be interpreted as appropriate. Words implied, but not stated shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Streamlined Language: The Specifications generally use the imperative mood and streamlined language. Requirements expressed in the imperative mood shall be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
- A. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.
- C. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited.
- D. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Engineer, requested by the Architect, and similar phrases.
- E. Approved: When used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, the term "approved," is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- F. Furnish: Furnish means purchase, delivery and storage at the Project Site for installation under other Sections or by the Owner.
- G. Install: Includes operations at the Project Site including the actual unpacking, preparation, assembly, erecting, placing, anchoring, supporting, connecting,

applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations required for a complete installation ready for the intended use.

- H. Provide: Provide means to furnish and install.
- I. Project Site: Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work 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 on which the Project is to be built.
- J. Testing Agencies: A testing agency 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.
- K. Product Data: Product data sheets include the manufacturers standard catalog information with illustrations, standard schedules, diagrams, performance charts, instructions, and brochures that illustrate physical appearance, size, weight, and other general characteristics of materials and equipment for some portion of the work.
- L. Shop Drawings: Shop drawings are detailed drawings, diagrams, illustrations, and schedules specifically prepared by the installing contractor or supplier to illustrate some portion of the work.
- M. Fabrication Drawings: The installation shop drawings required by the work of the various Sections of the Project Manual, such as sheet metal and sprinkler shop drawings, and normally prepared by the installing sub-contractor.
- N. Coordination Drawings: The coordinated installation shop drawings normally prepared by the installing sub-contractors indicating multiple building systems and interdisciplinary work on a single set of coordinated documents.
- O. Piping: Includes all necessary piping system components, including pipe, fittings, couplings, gaskets, flanges, unions, valves, strainers, hangers, supports, attachments, insulation, and identification.
- P. Substitutions: Substitutions include manufacturers not listed as acceptable within the specifications, or materials, products, systems, or equipment, which differ from the requirements of the Contract Documents.
- Q. Regulations: Regulations include laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

- R. NRTL: Nationally Recognized Testing Laboratory such as Underwriters Laboratory, Inc. or Factory Mutual Research Corporation.
- S. Life Safety Systems: Life Safety Systems include all fire protection systems, devices, and equipment used to detect fire, activate alarms, suppress or control fire and smoke, or any combination thereof.

1.5 SUBMITTALS:

- A. General Requirements: Comply with pertinent Submittals, the Sections of Division 21 – Fire Protection, and the additional requirements of this Section.
- B. Materials List: Within 30 calendar days after the Contractor has received the Owner's Notice to proceed, submit a list of the proposed materials to be provided under the work of the Fire Protection Sections of Division 21.
- C. Organization of Submittals: Bind submittals into comprehensible packages with related product data sheets and shop drawings organized and identified by Specification Section and Article numbers and titles. Bind submittals into packages in order as specified in the Sections of Division 21. Identify submittal pages to indicate the specific equipment or fixture type the data sheet applies to by Article number and title. Submittals, which are not properly bound and identified, may be returned without review.
  - 1. Indicate appropriate model numbers in manufacturers' brochures and cross out non-applicable information.
  - 2. Copies of faxed pages are unacceptable.
  - 3. Submit shop drawings for particular systems complete, simultaneously, and organized by system.
- D. Submittal Cover Sheet: Provide a completed cover sheet with each submittal package indicating the information on the following sample page:

| SUBMITTAL COVER SHEET                                                                                            |        |              |
|------------------------------------------------------------------------------------------------------------------|--------|--------------|
| PROJECT:                                                                                                         |        | CONTRACTOR:  |
| SECTION NO.:                                                                                                     |        | ARTICLE NO.: |
| DESCRIPTION:                                                                                                     |        |              |
| CONTRACT DRAWING REFERENCE NO.:                                                                                  |        |              |
| EQUIPMENT IDENTIFICATION TAG NUMBER:                                                                             |        |              |
| SUBMISSION (CIRCLE ONE): FIRST, SECOND, THIRD, FOURTH                                                            |        |              |
| DATE:                                                                                                            |        |              |
| INFORMATION AND CHECKLIST                                                                                        | REPLY  | COMMENTS     |
| 1. Contractor's Log #ID                                                                                          |        |              |
| 2. Name, address, and phone number of supplier.                                                                  |        |              |
| 3. Are all specified or scheduled items included and exactly match scheduled/specified items?                    | Yes No |              |
| 4. Is this item a substitution?                                                                                  | Yes No |              |
| 5. Are deviations clearly identified?                                                                            | Yes No |              |
| 6. Does equipment fit space shown on construction documents, coordination drawings, and actual field conditions? | Yes No |              |
| 7. Has support, erection, weights, and installation been coordinated with all trades?                            | Yes No |              |
| 8. Does the proposed installation void warranties or violate UL or code requirements?                            | Yes No |              |
| 9. Does this material/equipment add expense to any other trade or project costs?                                 | Yes No |              |
| 10. Does equipment require interface with other trades? List sections and specifics requiring coordination?      | Yes No |              |
| 11. Is control interface coordinated?                                                                            | Yes No |              |
| 12. List electrical characteristics (V/Ph/A)                                                                     |        |              |
|                                                                                                                  |        |              |
|                                                                                                                  |        |              |

- E. After approval of the proposed materials list, provide complete submittals as soon as possible and with adequate time for processing in order to not delay the project.
- F. Submit for review of all projects specific reproducible drawings, one reproducible and one print of each drawing. Submit for review pdfs of detailed Shop Drawings and Product Data. Submittals for review shall include complete Specifications, including type of materials, electrical characteristics, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted, including wiring diagrams shall be complete for all equipment and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated using a method that will be visible after photocopying.
- G. Contractor's Review: Review, stamp and certify each submittal prior to submission to the Architect. The certification shall state that the data and details contained on each Shop Drawing, Product Data, layout drawing, catalog data and brochure has been reviewed and that it complies with the Contract Documents in all respects. Shop Drawings, layout drawings, catalog data and brochures will not be reviewed and will be returned unchecked unless they are certified, and all items specifically identified.
- H. Multiple submissions: It is intended that Submittal data be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit" only one additional submission will be permitted.
  - 1. If the second submission is not acceptable, or if the submittal is not made within the specified time frame, the right of substitution and selection will be lost. At that time, the specified item shall be provided at no additional cost.
- I. Required Review Time: A minimum period of ten working days, exclusive of transmittal time, will be required in the Engineer's office each time Shop Drawings, Product Data, layout drawings, catalog data and brochures are submitted or resubmitted for review. A minimum period of fifteen working days exclusive of transmittal time will be required for reviewing substitute materials or manufacturer. The required review time, including multiple submission, shall be considered when scheduling the work.
- J. Submit Shop Drawings and Product Data sheets in a timely manner sufficiently in advance to give ample time for reviewing, correcting, resubmitting and re-reviewing if necessary. No claim for delay will be granted for failure to comply with this requirement.
- K. Equipment shall be of proper size for its allotted space. Equipment may be disassembled as required, where it does not invalidate the manufacturer's



warranty, so that it can be installed through available window, door, or louver openings.

- L. Schedule of Shutdowns: After the project construction schedule is developed, submit the following information to the Owner for all required shutdowns of existing systems.
  - 1. Date of proposed shutdown.
  - 2. List of systems to be affected.
  - 3. List of areas affected by the shutdown.
  - 4. Description of work to be performed.
  - 5. Estimated length of the shutdown.
- M. Piping Systems Schedule: Prepare and submit a schedule of Fire Protection piping systems to indicate the piping material, joints, and fittings to be used with each system.
- N. UL Through-Penetration Firestop System Schedule: Prepare and submit a schedule to indicate the UL-System number for through-penetration assemblies to be used with all mechanical systems. Coordinate with the work of the Penetrations and Fire Stopping Section in Division 7.
- O. Shop Drawings: Submit product data sheets and shop drawings as specified within the Fire Protection Sections of Division 21.
- P. Record Drawings: Prepare record drawings in accordance with the provisions of Division 1 governing - Project Record Documents and the additional requirements of this Section.
- Q. Valve Tag Charts: Prepare and submit valve tag charts as specified in this Section.
- R. Operation and Maintenance Manuals: Prepare and submit copies of the Operation and Maintenance Manuals as specified in the appropriate Section of Division 1 governing - Contract Close-out, and the additional requirements of this Section.
- S. Training Seminar Confirmation: Prior to the final completion of the project, submit copies of the training seminar sign in sheets and a letter to the Owner containing the names of training seminar participants, including instructor's names, the name of the firms represented and the dates of the instruction seminars.

- T. Engineer's Action: Except for items submitted solely for record purposes or information, the Engineer will review each submittal for general compliance with the Contract Documents, as defined in the General Conditions, and return the submittal with comments.
- U. Action Stamp: The Engineer will attach a Submittal Review sheet to each submittal package to indicate the status of the submission and the action taken, as follows:
  - 1. Furnish as Submitted: Submission is generally in compliance with the intent of the contract documents and fabrication may be undertaken.
  - 2. Furnish as Noted: Submission is generally in compliance with the contract documents and fabrication may be undertaken with the corrections noted.
  - 3. Revise and Resubmit: Submission is not in compliance with the contract documents and requires substantial corrections. Fabrication work may not be undertaken.
  - 4. Rejected: Submission is not in compliance with the contract documents. Resubmit as specified.
  - 5. Submit Specified Item: Second submission is not in compliance with the contract documents. Submit specified item without deviation.
  - 6. Reviewed for Comment Only: Engineer is not responsible for the approval of the submittal.

#### 1.6 QUALITY ASSURANCE:

- A. Qualifications: Use adequate numbers of skilled, licensed workers who are thoroughly trained and experienced and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Standard of Quality: The manufacturers names specified first or scheduled on the drawings are used for the design and to establish the standards of function, dimension, space requirements, appearance, and quality upon which the Contract is based. Acceptable manufacturers' names are listed to provide competitive bids with the specified or scheduled manufacturer.
  - 1. Acceptable Manufacturers: The inclusion of a manufacturer's name within the list of acceptable manufacturers does not necessarily mean that the manufacturer's standard product is equal to the specified or scheduled product without some required modification. The submitted product shall

be equal in terms of quality, durability, appearance, space requirements, weight, strength, and design to the product required by the Contract Documents.

- C. Contractor's Review: It is solely the Contractor's responsibility to verify that the products of acceptable manufacturers and proposed substitutes meet or exceed the performance of the specified or scheduled product. To be considered acceptable, products must comply with the following for the full possible performance range:

1. Horsepower: Equal or less.
2. Efficiency: Equal or greater.
3. Capacities: Equal or greater.
4. Space/Clearances: Equal or greater.
5. Storage and Recovery: Equal or greater.
6. Warranty: Equal or better.
7. Weight: Equal or less.
8. Noise: Equal or quieter.

- D. Substitutions: Substitutions include manufacturers not listed as acceptable within the specifications, or products, systems and methods, which differ from the specified systems.

1. Comply with the provisions of the Instructions to Bidders and pertinent sections in Division 1. Submit list of proposed substitutes for review and approval in compliance with the Instructions to Bidders, AIA Document A701.
2. By the submission of a proposed substitution, the Contractor represents that he has reviewed the proposed substitution and certifies that:
  - A. The proposed substitution does not affect dimensions shown on drawings.
  - B. Changes to the building design, including A/E design and review time at a rate of 2.6 x DPE, detailing and construction costs caused by the requested substitution will be included in the bid price with no additional cost to the Owner.
  - C. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
  - D. Maintenance and service parts are available locally.
  - E. All costs associated with or caused by the use of the proposed substitute will be covered by the Contractor.

E. Codes and Regulations:

1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies and authorities that have jurisdiction.
2. In case of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.

F. Qualifications for Welding and Brazing Work:

1. Qualify welding processes and welding operators in accordance with AWS Standard Qualification Procedure."
2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  - A. If recertification of welders is required, retesting will be the Contractor's responsibility.

G. Standards: Maintain copies of the most recent editions of the following standards at the job site for reference during construction:

1. UL Through Penetration Fire Stop Systems.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Protection: Use all means necessary to protect materials of the Fire Protection Sections before, during and after installation and to protect installed work and materials of all trades and Sections.
- B. Replacements: In the event of damage, immediately make all repairs and replacement necessary to the approval of the Engineer at no change in Contract Sum.

1.8 PROJECT CONDITIONS:

- A. Comply with Article 2 of the Instructions to Bidders, AIA Document A701, including the Appendix. Visit the site prior to submission of bids and examine existing conditions to be familiar with the related implications to the Work of the Fire Protection Sections.
  1. Questions regarding the Bidding Documents: Submit questions and requests for clarifications in compliance with the Instructions to Bidders.

- B. Contract Documents: The Contract Drawings are diagrammatic and do not show every fitting and component and shall be used in conjunction with the specified requirements to provide complete and fully functional systems for the intended use. The drawings and specifications are complimentary, and the requirements indicated on both establish the requirements of the Contract.
  - 1. The Contract Drawings indicate the general locations of equipment and distribution systems throughout the project. The actual installation locations shall be coordinated by the contractor on site based on actual field measurements performed by the contractor.
- C. Document Review: Review the complete set of Contract Documents and be familiar with the space requirements and work of other Sections. Thoroughly review building sections, architectural details, space availability phasing requirements and mechanical drawings for a complete understanding of the scope and coordination requirements of the Fire Suppression Sections.
- D. Scheduled Equipment: Standard manufacturers model numbers scheduled on the drawings shall be modified as specified in the descriptive specification for the scheduled equipment. The drawings generally define quantities, and the specifications further define equipment quality and system components, which may not be included in the standard model number.
- E. Pipe sizing notations: Pipe sizing notations run along the pipe from the larger sizes to the smaller size. Sections of pipe, which are not specifically identified with a pipe size, are the continuation of the previous larger pipe size indication. Pipe sizes change only where indicated by a notation change.
- F. Existing Conditions: The existing conditions indicated on the contract drawings are taken primarily from existing record drawings provided by the Owner and do not necessarily indicate actual as-built conditions. Preparation work of the mechanical and electrical sections includes the verification of existing conditions before the start of related installation work.

#### 1.9 COORDINATION DRAWINGS:

- A. Prepare coordination drawings for the work of Divisions 21, 22, 23, 26, and 28, in compliance with the requirements of Division 1 and the additional requirements of this Section.
- B. Coordination drawings shall indicate how work provided under different sections will be coordinated and installed in the available spaces. Coordination drawings shall also indicate the sequence of installation work of the various sections. Coordination Drawings shall include work by sub-contractors and fabricators

when off-site fabrication of work and production materials will interface with other trades.

- C. Each of the following sub-contractors shall indicate their work on architectural backgrounds available on AutoCAD or Revit electronic files. Coordination drawings shall show the work of all major trades without excluding the work of any particular trade. Coordination drawings shall include, but not be limited to, the work of the following trades:
  - 1. Sheetmetal
  - 2. Plumbing
  - 3. Steamfitter/Pipefitter
  - 4. Sprinkler/Fire Suppression
  - 5. Electrical
  - 6. Telecommunications
- D. Contractor shall produce 3/8-inch scale or larger, reproducible drawings produced on AutoCAD or Revit that shall include the following general information:
  - 1. Outline of all structural grid reference lines.
  - 2. Elevation reference lines.
  - 3. Structural steel beam sizes and column layout.
  - 4. Partition and door layout.
  - 5. Room or space number.
  - 6. Fire rating of partition penetrations.
  - 7. Acoustical ceiling layout.
  - 8. Firewalls and smoke partitions.
- E. Copies of the coordination drawings shall be distributed to each subcontractor and subsequently each trade shall indicate its work and show elevations, sizes, pipe and duct insulation, junction boxes, and fixture sizes.
- F. Conflicts shall be identified for immediate attention and resolution. Upon resolution of all conflicts, the coordinated drawings shall be signed by all trades

and submitted to the Architect in accordance with Section 01 30 00, for review and confirmation of compliance with the Contract Documents.

- G. Additional work required to accommodate a trade that failed to coordinate his work in a timely manner will be paid for by the subcontractor who failed to coordinate his work.
- H. Where conflicts occur regarding the location of materials of various trades, the Contractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initiated and dated by the specialty trade. The Contractor shall then final date and sign each drawing.
- I. A sub-contractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- J. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect and have been reviewed.
- K. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- L. Coordination Drawings shall include the following work:
  - 1. Structural elements.
  - 2. Partition/room layout.
  - 3. Ceiling grid.
  - 4. Lighting fixtures.
  - 5. Smoke and heat detectors.
  - 6. Access panels.
  - 7. Sheetmetal, heating coils, boxes, grilles, diffusers, etc.
  - 8. All HVAC piping and valves.
  - 9. Fire and smoke dampers.
  - 10. Fire rated sleeves.

11. Soil, waste and vent piping.
12. Water mains and branches.
13. Medical and specialty gas systems.
14. Fuel gas piping systems.
15. Roof drain piping.
16. Major electrical conduit runs, panelboards, feeder conduit and racks of branch conduit.
17. Miscellaneous metal support.
18. Fire standpipes and distribution piping.
19. Sprinkler piping and heads.
20. Heat tracing of piping.
21. Telecommunication and Building Control Conduits.
22. Seismic restraints.

1.10 WARRANTY:

- A. Upon completion of the Work and as a condition of its acceptance and final payment, deliver to the Architect two copies of a written Warranty agreeing to replace the work of Division 21, which fails due to defective materials or workmanship within one year after Date of Substantial Completion as that date is determined in accordance with the General Conditions. All compressors shall have the manufacturer's extended warranty for a total of five years.
- B. Failure due to defective materials or workmanship is deemed to include, but is not to be limited to:
  1. Failures in operating component or components.
  2. Leakage from piping system.
  3. Code violations.
- C. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.



- D. Replace material and equipment that require excessive service during warranty period as defined and as directed by Architect.
- E. Warranty shall include 24-hour service of complete system during warranty period at no cost to Owner. Choice of service organization shall be subject to Owner's approval.
- F. Include copy of warranty in the Operation and Maintenance Manuals.
- G. At end of warranty period, transfer manufacturer's equipment and material warranties still in force to Owner.
- H. This Article shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

#### 1.11 MANUALS AND INSTRUCTIONS:

- A. Comply with pertinent provisions of the appropriate Section in Division 1 regarding - Contract Closeout.
- B. Operation and Maintenance Manuals: Bind Manuals in hardcover, three-ring binders, and provide identified dividers with tabs. Indicate appropriate model numbers in manufacturers' brochures and cross out non-applicable information. Review the Manuals with the Owner's maintenance personnel and add additional maintenance data sheets and information as directed by the Owner's Representatives. Copies of faxed pages are unacceptable.
  - 1. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items. Assemble literature in coordinated manuals with additional information describing combined operation of field-assembled units, including as-built wiring diagrams. Manual shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment.
  - 2. Provide directions for and sequences of operation for Fire Suppression systems of Division 21. Sequence shall list valves, switches, and other devices used to start, stop and control systems.
  - 3. Lubrication instructions detailing type of lubricant, amount, and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first-class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.
- C. Furnish three copies of manuals to Architect for approval and distribution to Owner. Deliver manuals no less than 30 days prior to acceptance of equipment to

permit Owner's personnel to become familiar with equipment and operation prior to acceptance.

- D. Organization of Manuals: Divide manuals with identified tabs to match the mechanical and electrical specification sections numbers and titles. Separate product information within each section by the Article numbers and titles as listed in Part 2 of each specification section. Provide a clear see-through plastic holder on the edge of the binder with a typed card indicating the Project name, the Engineer's name, the Installer's name and the Volume number (e.g., Vol. No. 1 of 2).
- E. Manuals shall include the following materials and information for all specified materials and equipment:
  - 1. Table of contents.
  - 2. Emergency instructions with 24-hour phone number to contact a responsible individual for each Section of Work.
  - 3. Subcontractor's warranties.
  - 4. Name and telephone number of local representative and supplier.
  - 5. Manufacturers' maintenance procedures.
  - 6. Exploded drawings and parts lists.
  - 7. Troubleshooting checklists with potential problems and possible causes.
  - 8. Schematic wiring diagrams.
  - 9. Record drawings.
  - 10. Valve tag charts.
  - 11. Equipment warranties and guaranties.
  - 12. Sequence of Operations and Systems Descriptions.
  - 13. Additional requirements specified in other sections.
- F. Maintenance Information: Systems which require preventive maintenance to maintain efficient operation shall be furnished with complete necessary maintenance information. Required routine maintenance actions, as specified by the manufacturer, shall be stated clearly and incorporated on a readily accessible label on the equipment. Such label may be limited to identifying, by title or

publication number, the operation and maintenance manual for that particular model and type of product.

G. Instruction Seminars: Perform systems instruction seminars and walk-through with the Owner's designated representatives after preparation, review and approval of the Operation and Maintenance manuals by the Architect and Owner.

1. Record the names and firms represented of all training seminar participants, including all instructors and manufacturers representatives on a seminar sign in sheet.
2. During the instruction period the Operation and Maintenance Manual shall be used and explained.

H. As a minimum training sessions shall consist of the following:

1. General project information and review shall be by the General Foreman or Superintendent of the Trade.
2. Specific system and equipment training shall be by a Factory Trained Representative.
3. Provide a complete review of the project and systems including, but not limited to, the following:
  - A. In a classroom environment mount the drawings on an easel or equivalent and review each Record Drawing (can use typical).
  - B. Note equipment layouts, locations and control points.
  - C. Review each system.
  - D. Review system design operation and philosophy.
  - E. Review alarms and necessary responses.
  - F. Review areas served by various equipment and systems.
  - G. Identify color codes used.
  - H. Review features and special functions.
  - I. Review maintenance requirements.
  - J. Review operation and maintenance manuals.

- K. Respond to questions. Record questions and answers.
- 4. After classroom training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.
- 5. Training sessions shall be filmed and recorded for future use by the Owner.

#### 1.12 RECORD DOCUMENTS:

- A. Prepare record documents for the work of Division 21 as specified in Division 1 for Project Record Documents. The record drawings shall accurately indicate all valve locations and shall clearly show the assigned valve tag number. Record drawings shall include:
  - 1. Piping and equipment location changes from the Contract Documents.
  - 2. Updated schedules to indicate the scheduled characteristics of the actual installed equipment.
  - 3. Valve locations and valve tag numbers.
  - 4. Equipment identification numbers coordinated with the Owner's Facility Management Program.
  - 5. Locations of seismic restraints.
- B. Record drawings include ductwork, sprinkler and fabrication drawings required for all other systems and coordination drawings prepared under the work of this contract. Provide reproducible drawings and electronic AutoCAD or Revit drawing files of both the contract drawings and additional fabrication/coordination drawings that indicate mechanical and electrical systems. All electronic files shall be fully bound and submitted on CD format.

#### 1.13 ELECTRONIC DRAWING FILES:

- A. Electronic drawing files of floor plans and schedules on AutoCAD or Revit or DXF format will be made available by the engineer for the contractor's use to prepare fabrication, coordination, or record drawings. After the contractor requests the electronic files, a waiver will be provided for the contractor to sign and return them to Weston & Sampson, Inc. A service charge of one hundred dollars (\$100.00) per disc will be charged to cover the cost of the engineer's time and materials. After Weston & Sampson, Inc. receives the signed waiver the electronic drawing files will be forwarded to the contractor.

#### 1.14 PHASING AND CONTINUITY OF SERVICES:

- A. All construction phasing shall comply with the Architect's phasing drawings and specifications and the requirements of the General Contractor and as required to maintain continuity of mechanical and electrical services for all systems that must be kept in operation.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES AND PENETRATIONS:

- A. Piping penetrations through fire rated construction shall comply with a listed fire rated assembly as detailed in the UL Fire Resistance Directory. Pipe sleeves through floors, exterior walls and fire-rated construction shall be galvanized Schedule 40 steel pipe. Pipe sleeves through non-fire-rated partitions shall be 26-gauge galvanized steel.
  - 1. Sleeves Through Foundation Walls: Provide galvanized schedule 40 steel with continuous weld slip on welding flange water stop. Provide waterproof resilient link caulking assembly by Link-Seal or Sure-Seal.
  - 2. In areas where pipe or duct is exposed, install sleeves flush with the finish floor, except in mechanical rooms, and janitor's closets extend sleeves at least 4-inches above finish floor.
  - 3. Annular Space Requirements: Sleeves shall be sized to provide a total clearance of ½-inch around pipe or duct including insulation cover. Annular space around fire rated through penetrations assemblies shall be in compliance with the Listed Assembly.
  - 4. Packing between the pipe and sleeve in fire rated construction shall be a combination of listed insulation and fire-proof caulk. Coordinate with the work of the Division 7 Section for Penetration Firestopping.
  - 5. Core drilled holes in lieu of sleeves are acceptable except in mechanical rooms, janitor's closets or floors that can be flooded with water, which require sleeves installed above floors.
- B. Through Penetration Assemblies: The combination of materials shall have the same fire rating, in hours, as the wall or floor, as tested in accordance with the code referenced editions of ANSI/UL 1479 (ASTM E-814). The combination of materials shall be classified by UL for the fire rating required and shall be listed as a numbered system in the UL Fire Resistance Directory.

1. Caulking of pipe and duct penetrations through floor slabs, smoke barriers and fire rated partitions shall be performed under the Division 7 Section for Penetration Firestopping.

C. Waterproof Pipe Penetrations:

1. Modular mechanical penetrations seals shall be interlocking synthetic rubber links shaped to fill annular space continuously, with galvanized carbon steel bolts, nuts and pressure plates to expand rubber seal between pipe and sleeve. Sleeve seal shall be water-tight.
2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire-rated) or preformed mineral fiber or silicone foam seal (fire-rated).
3. Provide waterproof 1" single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs on grade and existing walls below grade.

- D. Provide adjustable escutcheons on exposed piping that passes through finished floors, walls, and ceilings. Escutcheons shall be chromium-plated cast brass, sized to cover sleeve opening and to accommodate pipe and insulation.

2.2 VALVE TAGS:

- A. Upon completion of piping installation work provide valve tags on all valves installed under the work of the Fire Suppression Sections. Valve tags shall be at least 1-1/2-inch diameter brass or engraved plastic with ¼-inch high lettering for service designation over ½-inch high consecutively numbered valve identification. Engraved valve tags shall be color coded as specified for piping identification. Coordinate valve tag numbers with the Owner's facility management program. Provide service designation prefix as scheduled:

- |    |                                 |         |
|----|---------------------------------|---------|
| 1. | Fire Protection Systems:        | Prefix: |
|    | A. Fire Line (Standpipe) Piping | FL      |
|    | B. Sprinkler Piping             | SP      |

2.3 PIPING IDENTIFICATION:

- A. Piping: Provide clip-on color-coded piping identification markers on mechanical piping systems specified in Division 21. Provide matching flow arrows to indicate direction of flow. Markers shall be equal to Seton Setmark. Pipe marking for outside diameters of 6-inches or greater may be springs or metal bands secured to

the corners at each end of the semi-rigid plastic marker to hold each end of the marker firmly against the pipe.

1. Color coding and size of legend letters shall comply with the standards of ANSI A13.1.
2. Fire Protection Systems: Provide red color-coded identification markers to identify horizontal fire line piping. Identify sprinkler piping with clip-on markers as specified or provide a 12-inch long painted red indication on the bottom half of concealed piping. Exposed sprinkler piping does not require identification markers when sprinklers are visible in plain view.
3. Protection Guards: Provide Armstrong Armaflex 2000 white elastomeric insulation.

#### 2.4 EQUIPMENT IDENTIFICATION:

- A. Stencil equipment such as pumps, compressors, nitrogen generator and tanks with the name of the equipment and equipment number. Stencils shall be at least 6-inches high and of a color to provide a contrast to equipment finish.
- B. Equipment markings shall be prominently displayed on each normally visible side of the equipment. Equipment intended for installation in finished areas shall have markings located behind normally used access panels mounted so as to be readily found. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings.

#### 2.5 PRESSURE VESSELS:

- A. Pressure vessels including provided under Division 21 shall be ASME rated construction. All pressure vessels and air tanks shall be installed in accordance with ASME 2019 Boiler and pressure Vessel code section VIII and 522 CMR Board of Boiler Rules 7.0 Air Tanks.

#### 2.6 ACCESS PANELS:

- A. Furnish access panels for all concealed equipment installed under Division 21 that require accessibility for the proper operation and maintenance of the system and as required by code. Access doors and panels shall be cold rolled steel with continuous piano hinge and prime coat of rust inhibitive paint.
- B. Sizes shall be sufficient for the access and removal of filters, etc. Access panels shall be no less than 12-inches by 12-inches except for valves installed within 12-inches of the door may be 8-inches by 8-inches.

C. Acceptable Manufacturers:  
Larsen's Manufacturing Co.  
Milcor  
Karp Associates, Inc.

1. Flush installation in drywall. Larsen L-DWR.
2. Flush installation in drywall surfaces, utilizing a concealed type frame. Larsen L-DWC
3. Large access openings in drywall ceilings and walls. Larsen L-LCP
4. For use in plaster surfaces, concealed frame with optional plaster ground. Larsen L-PSW.
5. Recessed doors pan with metal lath for plaster surfaces. Larsen L-APC
6. Recessed 5/8" door pan for acoustical tile. Larsen L-CPA
7. Fire-rated security access panels: Larsen L-DPFB
8. Exterior applications. Larsen L-XT
9. Multi-purpose access panel for use in plaster or drywall: Larsen L – MPG/L-MPSS
10. Wet Areas: Stainless Steel with No. 4 finish.

2.7 ELECTRICAL MOTOR REQUIREMENTS:

- A. Electrical motors shall conform to the requirements of IEEE, NEMA, U.L., K.E.C., F.M. and NFPA suitable for load conditions, squirrel cage, 1.15 service factor, drip proof, 1750 rpm unless otherwise noted, with inherent overload protection and pressure lubricated bearings with grease fittings. Provide totally enclosed fan cooled motors as noted within the specifications. Refer to ELECTRICAL CHARACTERISTICS REQUIREMENTS of Section 26 00 01 – ELECTRICAL WORK.
- B. Motors below 2 HP shall be 120V - 1 phase. Motors that are 1/2 HP and greater shall be in accordance with the electrical requirements. (Verify with Elec.) Motors that are 40 HP and larger shall have part wound motors that are compatible with starters. All other motors shall be designed for use with across-the-line starters. Motors to be provided with overload protection. Provide two speed motors where



noted on the drawings. Phase protection shall be provided on motors 1/2 HP and larger.

- C. Motor leads shall be permanently identified and supplied with connectors.
- D. The minimum requirement for three phase motors shall be NEMA Design B, Class B, insulated for a maximum 40 degree C (104 degrees F) ambient.
- E. Select motors for quiet, continuous operation to suit loads which may be imposed by equipment. Recognize that motor horsepower specified and scheduled are minimum sizes. Submit an accurate schedule of all motors. Include for each motor, the HP, RPM, nameplate, voltage, current, equipment served, location, electrical characteristics and identification number.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION:

- A. Inspect site conditions before starting preparatory work and verify that actual conditions are known and acceptable before starting work. Be familiar with the work of other sections, separate contractors, and the Owner.
- B. Inspect areas where piping, conduit, ductwork, fixtures and equipment will be installed and verify adequate space is available for access, service and removal of equipment. Coordinate with the Work of other Sections.
- C. Notify the Engineer immediately when the removal of existing ceilings, walls, or obstructions reveal conditions substantially different from the Contract Documents.

#### 3.2 PREPARATION:

- A. Perform coordination with the work of other Sections and prepare composite coordination drawings as specified in this Section before starting installation work of Division 21.
- B. Verify points of connection to existing systems and confirm that required system shutdowns are acceptable with the Owner before proceeding with any related installation work.

#### 3.3 SYSTEM SHUTDOWNS:

- A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shut downs as

much as possible. Submit a list of all effected areas, the proposed work to be performed, and the expected length of the shutdown including time for retesting.

#### 3.4 LIFE SAFETY SYSTEMS SHUTDOWNS:

- A. Maintain the existing Life Safety Systems in operation during construction and obtain impairment permits from the local Authorities Having Jurisdiction for all Life Safety Systems affected by the work of Division 21.
- B. Safeguarding Construction: Provide fire watch, portable extinguishers, and safety procedures in compliance with 527 CMR 39.00, 780 CMR 3305 and NFPA 241.

#### 3.5 REMOVAL WORK:

- A. Particular care shall be taken to avoid creating hazards on the site or causing disruption of service in the adjoining buildings.
- B. All existing equipment and material indicated to be removed shall be done in a neat and workmanlike manner. All existing equipment indicated to be turned over to the Owner shall be presented to the Owner in good condition at a location designated by the Owner. All other existing equipment and all material that is removed shall be removed from the premises.
- C. Remove all abandoned piping, ductwork and equipment not built into building construction. Where ceilings or walls are removed all abandoned duct, conduit and piping shall be removed and the ends of live services capped. Abandoned elements built into walls or located above existing ceilings that are not being removed shall remain. All duct and pipe ends shall be capped and be marked abandoned.
- D. All equipment and materials that are removed from the premises shall be legally disposed of. Particular attention shall be taken regarding the disposal of any and all hazardous materials. Provide written manifests and certifications of legal disposal or recycling of all hazardous materials.

#### 3.6 CORE DRILLING:

- A. Do not core new concrete structure without written approval from the Engineer.
- B. Perform all core drilling required for the proper installation of the work of Division 22. Locate all required openings and prior to coring coordinate the opening with the other Trades and obtain approval from the Engineer.
- C. Thoroughly investigate the existing conditions in the vicinity of the required opening prior to cutting. Take care so as not to disturb the existing building

systems. Damage to existing conditions incurred during core drilling shall be corrected to the Owners satisfaction with no additional expense to the Owner.

### 3.7 CUTTING AND PATCHING:

- A. Cutting and patching shall be performed under other Sections. Locate all other than cored openings required for the installation of the mechanical piping systems. Coordinate the opening with the work of the other trades so as not to interfere with the work of other Sections. Thoroughly investigate the existing conditions in the vicinity of the required openings as much as possible.
- B. Patching of the existing walls around openings shall be performed by the respective trade responsible for the finish material in which the opening is made.

### 3.8 SLEEVES AND PENETRATIONS:

- A. Coordination: Closely Coordinate electrical conduit, mechanical piping and ductwork penetrations through floor slabs and fire rated walls with the other Sections of Division 21 and the requirements of Division 7 – Penetration Firestopping. Penetrations through fire rated construction shall consist of a complete rated assembly.
  - 1. UL -Listed through Penetration Components: In addition to the fire stop caulking provided under Division 7, the components of a fire rated through penetration assembly include the piping size and material, annular space, and insulation type, density and thickness.
  - 2. Prepare a schedule of UL Through Penetration System numbers for submission and approval.
- B. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- C. Extend sleeves through Mechanical Room and other potentially wet floors at least 4-inches above finished floor level and provide pipe support sleeve.
- D. Install cast brass chrome plated escutcheons where piping passes through finished surfaces.

### 3.9 GENERAL INSTALLATION REQUIREMENTS:

- A. General: Coordinate with the work of other trades before starting installation. Install materials and equipment in accordance with the Manufacturers latest printed installation instructions and the product NRTL listing requirements.

1. Install piping straight, plumb and form right angles on parallel lines with building walls. Locate groups of pipes parallel to each other. Provide sufficient spacing for insulation and valve access.
2. Install systems as high as possible to maximize ceiling heights.
3. Pipe shall be free from scale and dirt. Protect open ended pipe ends to prevent debris from entering. All piping shall be reamed free of burrs.
4. Locate valves for easy access and operation. Install valve stems above the horizontal.
5. Piping connections to equipment shall be made with off-sets provided with isolation valves, unions or flanges arranged so that equipment can be serviced or removed without dismantling.
6. Provide for expansion and contraction in all piping systems to prevent undue strains on piping or equipments. Provide double off-sets at risers to take up expansion.
7. Install equipment with care to minimize damage to shop applied finishes. Replace or repair damaged components or finishes incurred during shipping and installation to the Owners satisfaction.
8. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
9. Cut pipe accurately and work into place without springing or forcing, and properly clearing windows, doors, and other openings.
10. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
11. Make changes in directions with fittings, make changes in main sizes with eccentric reducing fittings. Install water supply and sprinkler piping with straight side of eccentric fittings at top of the pipe.
12. Run piping concealed above ceilings and within furred spaces. Take special care to locate stacks and risers within pipe chases as indicated on the Architectural Drawings. Obtain approval from the Architect for piping locations which require furrings not indicated on the Contract Drawings.

13. Install equipment and components to minimize noise and vibration transmission to the structure. Provide vibration isolators and flexible connectors for all vibrating equipment.
14. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system.
15. Support piping independently at pumps, tanks and similar locations, so that weight of piping will not be supported by the equipment.
16. Pipe the drains from pump glands, drip pans, relief valves, air vents and similar locations, to spill through an air gap into a floor drain.
17. Securely bolt all equipment, isolators, hangers, and similar items in place.
18. Provide complete dielectric isolation between ferrous and non-ferrous metals.
19. Do not install plastic piping systems when the ambient temperature is below 60 degrees F.
20. Provide Armstrong Armaflex 2000 white insulation on pipe hangers, duct hangers, duct flanges, the edge of ductwork, and to the sharp edges of mechanical systems when located below 6'-8" above the floor.
21. Insulating Clamps: Provide IPS Corp. Strap-Tite insulating clamps on uninsulated copper piping installed through metal stud perforations.

B. Equipment Access for Maintenance and Removal:

1. Install piping, equipment and accessories to permit access for maintenance as specified by the equipment manufacturer. Provide adequate clearance to disconnect equipment for removal. Locate valves and unions so additional piping removal is not necessary to remove equipment. Coordinate piping and equipment locations with all trades to ensure adequate clearance is maintained for equipment maintenance and removal.
2. Relocate items as necessary to provide access for maintenance and removal without additional cost to the Owner.

3.10 ACCESS PANELS:

- A. Access Panels: Comply with the appropriate Section of Division 8 specifying Access Panels.

- B. Furnish access panels for installation under other sections to allow access to mechanical equipment and devices installed under Divisions 21. Furnish access panels for mechanical and electrical devices installed behind permanent construction such as gypsum wallboard partitions and ceilings or concrete masonry walls and partitions.
- C. Devices provided under the work of Divisions 21 that require access include, but are not necessarily limited to; valves, air release valves; fire and smoke dampers, smoke detectors, filters, junction and pull boxes.
- D. Coordinate with the Architectural reflected ceiling plans, room elevations and finish schedules for locations where the above panels are applicable. Coordinate all work with the General Contractor/Installer. Locations of all access panels shall be coordinated with the Architect prior to locating items that require an access panel. Access panels will not be allowed in any wall finished with brick, structural glazed facing tile, or wood.
- E. Access panels shall be large enough to provide access for maintenance and removal of mechanical and electrical equipment and devices.
- F. Access panels shall have same fire rating classification as the construction penetrated.
- G. Panels shall be at least 12" x 12"; access panels at equipment shall be 18" x 18".

### 3.11 VALVE TAG CHARTS:

- A. Prepare valve tag charts to indicate the location of all valves by room name and number as identified on the architectural floor plans. Indicate areas, floors, or specific rooms controlled by each valve. Provide valve tag charts for each system as specified in Part 2 of this Section.
- B. Coordinate valve tag numbers with the Owner's facility management programs.

### 3.12 IDENTIFICATION OF PIPING AND EQUIPMENT:

- A. Piping: Install pipe and conduit identification markers in compliance with ANSI A13.1 on each side of wall penetrations, at each valve, at tee fittings, behind access panels and base of risers. The spacing of markers shall not exceed 20 feet and shall include at least one marker in each room. Ensure that markers are visible from 4-foot 6-inches to 6-feet above the finish floor.
  - 1. Install markers on painted piping only after painting is complete and has been accepted by the Architect. Install marker adjacent to access panels where piping is concealed.

- B. Equipment: Stencil equipment such as pumps, compressors, and tanks with the name of the equipment and equipment number. Coordinate equipment numbers with the Owner's maintenance personnel. Stencils shall be at least 6-inches high and of a color to provide a contrast with the equipment finish.
- C. Equipment markings shall be prominently displayed on each normally visible side of equipment. Equipment intended for installation in the finished area shall have markings located behind normally used access panels mounted so as to be readily found. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings.

### 3.13 FIRE WATCH:

- A. Provide a fire watch as required by Division 1 when performing work which may cause a fire, such as welding or torch cutting work.

### 3.14 SCAFFOLDING, HOISTING, RIGGING AND STAGING:

- A. Provide scaffolding, hoisting, rigging, conveyance apparatus and staging in conformance with Section 01 50 00 as required to perform the work specified in the Fire Protection sections of Division 21.

### 3.15 RECORD DOCUMENTS:

- A. Project Progress and Record Drawings: Comply with the appropriate Section of Division 1 governing Project Record Documents and the additional requirements of this Section.
  - 1. Maintain a daily record of the project construction progress by coloring the work completed on the white prints furnished by the Owner at the commencement of the work.
  - 2. Modify the equipment schedules to reflect data consistent with that of the installed equipment. Clearly show all changes to the work as a result of addenda, change orders, clarifications, instructions issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new work and their relationship to existing work. Provide dimensions from permanent site improvements or column centerlines.
  - 3. The marked up and colored in prints will be used as a guide for determining the progress of the work installed. They shall be inspected weekly and shall be corrected immediately if found inaccurate or incomplete. Requisitions for Payment will not be approved until the Drawings are accurate and up to date.

- B. At the completion of the work submit one set of the marked-up prints for review and acceptance. After acceptance, these marked up record prints shall be used to prepare the Owner's final Record Drawings.
- C. Maintain the established layering, color and pen thickness scheme on modified electronic drawing files.
- D. Make all modifications on the AutoCAD or Revit Drawing files indicated on the approved marked up set of Record Drawings. Remove all superseded data to show the completed installation.
- E. The final approved AutoCAD or Revit Record Drawing files shall become the property of the Owner.
- F. Deliver the completed Record Documents properly titled and dated to the Architect. These Record Documents shall become the property of the Owner.

### 3.16 SYSTEM START-UPS AND INSTRUCTIONS:

- A. Start-Ups: Perform system and equipment start-ups in accordance with the manufacturers' printed start-up instructions in the presence of the manufacturers' representatives.
  - 1. Perform initial systems start up for all Life Safety Systems with the manufacturers' representatives and provide complete integrated systems testing and verification as detailed in the Fire Protection Narrative before notifying the approving Authorities having Jurisdiction. Make all necessary adjustments, corrections and changes and retest the systems with the manufacturers' representatives present during the final testing and preliminary acceptance tests.
  - 2. After the successful completion of all preliminary Life Safety Systems acceptance tests notify the approving Authorities having Jurisdiction.
  - 3. Perform the final Life Safety Systems acceptance tests as detailed in the Fire Protection Narrative with the Manufacturers' Representatives, Authorities having Jurisdiction and Owner's Maintenance and Facility staff in attendance.

### 3.17 CONSTRUCTION CERTIFICATIONS AND AFFIDAVITS:

- A. Engineer's Responsibility: During construction, the Engineer is responsible for the following services as defined by the Massachusetts State Building Code, 780 CMR Section 107.6.2:



1. Review, for conformance to the design concept, shop drawings, samples and other submittals, which are submitted by the contractor in accordance with the requirements of the construction documents.
  2. Review and approval of the quality control procedures for all code-required controlled materials.
  3. Be present at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the work and to determine, in general, if the work is being performed in a manner consistent with the construction documents.
- B. Contractor's Responsibility: The Contractor is solely responsible for the completion of the work on schedule and in compliance with the Contract Documents and the applicable codes; and for scheduling sufficient time for all required testing and submissions and approvals.
1. Construction Affidavits: If upon the completion of the construction, the Building Official requires Affidavits from a Professional Engineer stating that the Contractor's work is in accordance with the approved construction documents and with applicable local, state and federal statutes and regulations as required by 780 CMR 107.3, the Contractor shall retain the services of a qualified Registered Professional Engineer to be on site during construction.
  2. Submission Schedule: Allow sufficient time for the initial submission; Architect/Engineer review; resubmission; and final review and approval of all documents required for acceptance of the request for a Certificate of Occupancy in accordance with 780 CMR 111.
  3. In accordance with 780 CMR 903.4, submit copies of the approved fire protection shop drawings, "As-Built" record drawings and completed contractor's test and material certificates to the building official and head of the fire department before scheduling the final fire protection/life safety systems operational acceptance tests.
  4. Testing Schedule: Allow sufficient time for the initial testing, adjustments, and final functional operational testing of all fire protection systems as outlined in the Fire Protection Narrative.
- C. Construction Certifications: After the Contractor submits signed Certifications of Compliance as required by the Massachusetts State Building Code, 780 CMR, Section 107.3, and complies with the requirements of 780 CMR 111, the responsible engineers will provide written certifications to confirm that to the best of the engineer's knowledge, information, and belief, the finished work is in compliance with the approved drawings issued for permit.

1. Prior to submission of the final signed Certifications of Compliance, the Contractor shall submit written responses to all punch list items submitted by the design team.
2. The engineer will not submit certifications until all required certifications of testing, compliance and completion of punch list items have been submitted to the engineer.

### 3.18 ADDITIONAL REQUIREMENTS FOR THE COMPLETION OF THE PROJECT

#### **Tenth Edition 780 CMR 107.6 Construction Control Document**

##### *Construction Contractor Services Certification Pursuant to Section 107.6.3*

**Name of Contractor:** \_\_\_\_\_

If a Corporation, name of responsible Corporate Officer:

\_\_\_\_\_

If a DBA or Partnership, name of individual:

\_\_\_\_\_

I hereby certify that, to the best of my knowledge and belief, construction performed under permit number \_\_\_\_\_ issued on \_\_\_\_\_ has been completed in substantial accord with the approved construction documents, with all pertinent deviations specifically noted per Section 107.6.3 of the Massachusetts State Building Code (780 CMR), 10<sup>th</sup> Edition Base Volume.

**Name of Project:** \_\_\_\_\_

**Address of Project:** \_\_\_\_\_

**List of Pertinent Deviations:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Print Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Notarized by:** \_\_\_\_\_

#### **Standard Notary Statement:**

This document shall be submitted to the *Responsible Registered Design Professional* (RDP) and, when requested, to the Building Official in accordance with 780 CMR section 107.6.3 (10<sup>th</sup> edition) at the completion of all construction projects performed pursuant to 780 CMR Section 107.6 *Control Construction*.

# **REQUIREMENTS FOR THE ISSUE OF FIRE PROTECTION FINAL CONSTRUCTION AFFIDAVIT Cover Sheet**

All required documents shall be provided as a single submission attached to this sign off sheet.

|                                                                                                                                                                                                     |                       |      |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-----------|
| <b>The Fire Protection Contractor shall provide notarized certificates of completion for the work done by the Contractor and each of the sub subs including but not limited to (form attached):</b> |                       |      |           |
|                                                                                                                                                                                                     | Attached<br>(Y,N, NA) | Date | Signature |
| Signed off and stamped Post Construction Affidavit                                                                                                                                                  |                       |      |           |
|                                                                                                                                                                                                     |                       |      |           |
| Other:                                                                                                                                                                                              |                       |      |           |

|                                                                    |                       |      |           |
|--------------------------------------------------------------------|-----------------------|------|-----------|
| <b>Minimum documentation required</b>                              |                       |      |           |
|                                                                    | Attached<br>(Y,N, NA) | Date | Signature |
| Approved pipe pressure test reports                                |                       |      |           |
| Fire Protection Equipment Data Sheets and operation instruction    |                       |      |           |
| Approved Testing Reports                                           |                       |      |           |
| Stamped As-Built Drawings                                          |                       |      |           |
| Fire chief signature for duct smoke detectors (by electrical)      |                       |      |           |
| Copy of NFPA-25 as a part of O&M Manual                            |                       |      |           |
| Up to date monetized punch list                                    |                       |      |           |
| Contractor's Material Certificate for Above and Underground piping |                       |      |           |
|                                                                    |                       |      |           |
| Other:                                                             |                       |      |           |

## OPERATIONS & MAINTENANCE MANUALS CHECK LIST & SIGN OF COVER SHEET

|                                                                                      | INITIAL |
|--------------------------------------------------------------------------------------|---------|
| All O&M's shall be assembled with dividers with tabs.                                |         |
| Dividers for equipment shall be sorted by Section Number.                            |         |
| O&M manuals shall include the following:                                             |         |
| Table of Contents                                                                    |         |
| Warranties (including subcontractors)                                                |         |
| Contractor contact list, normal & emergency                                          |         |
| Vendors contact list                                                                 |         |
| Valve tag chart                                                                      |         |
| All equipment in project                                                             |         |
| Air Tank inspection (if OWNER's insurance or state requires)                         |         |
| Record drawings including the following:                                             |         |
| All ductwork, piping, and equipment location changes from the contract documents     |         |
| Updated schedules of actual equipment installed if different from contract documents |         |
| Valve locations and valve tag numbers                                                |         |
| Equipment identification numbers                                                     |         |
| Seismic restraint locations                                                          |         |

END OF SECTION

## SECTION 21 05 23

### GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:

Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS

Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

Section 21 11 19 – FIRE-DEPARTMENT CONNECTIONS

Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS

Section 21 13 16 – DRY-PIPE SPRINKLER SYSTEMS

Section 21 05 48 – VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

##### 1.3 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.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

#### 1.4 DEFINITIONS:

- A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. SBR: Styrene-butadiene rubber.

#### 1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of valve.

#### 1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, and weld ends.
  3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES:

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.
  - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
  - b. Level 1: HLOT - Valves.
    - 1) Level 3: HLUG - Ball Valves, System Control.
    - 2) Level 3: HLXS - Butterfly Valves.
    - 3) Level 3: HMER - Check Valves.
    - 4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

- a. Level 1: VQGU - Valves, Trim and Drain.

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.
      - a) Single check valves.
    - 3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.



- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. 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. Available Manufacturers: Nibco Inc., Victaulic Company or Conbraco.
- B. Description:
  - 1. UL 1091, except with ball instead of disc and FM Global standard 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 or traveling nut.
  - 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. Available Manufacturers: Globe Fire Sprinkler Corporation, Milwaukee Valve Company and Victaulic 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.

7. Actuator: Worm gear or traveling nut.
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. Available Manufacturers: Globe Fire Sprinkler Corporation, Tyco Fire Products, and Victaulic Company.

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, EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

#### 2.5 CHECK VALVES:

A. Available Manufacturers: Anvil International, Tyco Fire Products, Victaulic Company, and Viking Corporation.

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.

#### 2.6 BRONZE OS&Y GATE VALVES:

A. Available Manufacturers: Nibco Inc. and Milwaukee Valve Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES:

A. Available Manufacturers: Hammond Valve, Mueller Company and Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES:

A. Available Manufacturers: Hammond Valve, Mueller Company and Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

## 2.9 INDICATOR POSTS:

A. Available Manufacturers: Hammond Valve, Mueller Company and Victaulic Company.

B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Wall
3. Base Barrel Material: Cast or ductile iron.
4. Cap: Cast or ductile iron.
5. Operation: Handwheel.

## 2.10 TRIM AND DRAIN VALVES:

A. Ball Valves:

1. Available Manufacturers: Hammond Valve, Mueller Company and Victaulic Company.
2. Description:
  - a. Pressure Rating: 175 psig.
  - b. Body Design: Two piece.
  - c. Body Material: Forged brass or bronze.
  - d. Port size: Full or standard.
  - e. Seats: PTFE.
  - f. Stem: Bronze or stainless steel.
  - g. Ball: Chrome-plated brass.
  - h. Actuator: Handlever.
  - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
  - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Available Manufacturers: Hammond Valve, Mueller Company, and Victaulic Company.
2. Description:
  - a. Pressure Rating: 175 psig.
  - b. Body Material: Brass or bronze.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION:

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  - 1. Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING for application of valves in fire-suppression water-service piping outside the building.
  - 2. Section 21 11 19 – FIRE DEPARTMENT CONNECTIONS for application of valves in fire connections.
  - 3. Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS for application of valves in wet-pipe, fire-suppression sprinkler systems.
  - 4. Section 21 13 16 – DRY-PIPE SPRINKLER SYSTEMS for application of valves in dry-pipe, fire-suppression sprinkler systems.
- 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 check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- 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 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS 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.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION

## SECTION 21 05 29

### HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT (FILED SUB-BIDS REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 RELATED DOCUMENTS:

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

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal hanger-shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.
- B. Related Requirements:
  - 1. Section 01 40 00 “Quality Requirements”
  - 2. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 3. Section 07 84 00 “Firestopping”

#### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Include design calculations for designing trapeze hangers.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 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 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test 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 METAL PIPE HANGERS AND SUPPORTS:

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

## 2.3 TRAPEZE PIPE HANGERS:

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.4 FASTENER SYSTEMS:

- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Indoor Applications: Zinc-coated or Stainless steel.
  - 2. Outdoor Applications: Stainless steel.

## 2.5 EQUIPMENT SUPPORTS:

- A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

## 2.6 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:

- A. Comply with requirements in Section 07 84 13 "Penetration 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 shall be weight of supported components plus 200 lb.

#### 3.2 HANGER AND SUPPORT INSTALLATION:

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: 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 from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.
- D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

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 according to 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 according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

### 3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS:

- A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- B. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.5 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.

### 3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Sections 099113 "Exterior Painting," Section 099123 "Interior Painting", and Section 099600 "High-Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.7 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 attachments for general service applications.
- F. 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.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Comply with NFPA requirements.
- I. 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.
- J. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

## SECTION 21 05 48

### VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT (FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:

Section 03 30 00 – CAST-IN-PLACE CONCRETE

Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS

Section 21 13 16 – DRY-PIPE SPRINKLER SYSTEMS

##### 1.3 SUMMARY:

##### C. Section Includes:

- 1. Elastomeric isolation pads.
- 2. Elastomeric isolation mounts.
- 3. Restrained elastomeric isolation mounts.
- 4. Pipe-riser resilient supports.
- 5. Resilient pipe guides.
- 6. Elastomeric hangers.
- 7. Snubbers.
- 8. Restraint channel bracings.
- 9. Seismic-restraint accessories.
- 10. Mechanical anchor bolts.

11. Adhesive anchor bolts.

1.3 DEFINITIONS:

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
  - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
  - 3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
  - 4. Seismic-Restraint Details:



- a. Design Analysis: To support selection and arrangement of seismic 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 seismic events. Indicate association with vibration isolation devices.
- c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE:

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS:

#### A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: E.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III
  - a. Component Importance Factor: 1.5.
  - b. Component Response Modification Factor: 3.5.
  - c. Component Amplification Factor: 2.25.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.192
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.063.
5. Seismic design Category: C
6. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

### 2.2 ELASTOMERIC ISOLATION PADS:

#### A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Smooth pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric.
  - a. Surface Pattern: Smooth pattern.
  - b. Infused nonwoven cotton or synthetic fibers.

### 2.3 ELASTOMERIC ISOLATION MOUNTS:

#### A. Double-Deflection, Elastomeric Isolation Mounts:

1. 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.
- 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS:

### A. Restrained Elastomeric Isolation Mounts:

- 1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - a. Housing: Cast-ductile iron or welded steel.
  - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene or other elastomeric material.

## 2.5 PIPE-RISER RESILIENT SUPPORT:

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.
  - 1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  - 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

## 2.6 RESILIENT PIPE GUIDES:

- A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
  - 1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.7 ELASTOMERIC HANGERS:

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.8 SNUBBERS:

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

## 2.9 RESTRAINT CHANNEL BRACINGS:

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with 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.

## 2.10 SEISMIC-RESTRAINT ACCESSORIES:

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

## 2.11 MECHANICAL ANCHOR BOLTS:

- A. Mechanical Anchor Bolts: 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 according to ASTM E 488.

## 2.12 ADHESIVE ANCHOR BOLTS:

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

# PART 3 - EXECUTION

## 3.1 EXAMINATION:

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATIONS:

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

### 3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION:

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 – CAST-IN-PLACE CONCRETE.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 07 72 00 – ROOF ACCESSORIES for installation of equipment supports and roof penetrations.
- D. Equipment Restraints:
  - 1. Install seismic 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 seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. 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.
- I. 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.
- J. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other

embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: 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.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION:

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS for piping flexible connections.

### 3.5 FIELD QUALITY CONTROL:

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  5. Test to 90 percent of rated proof load of device.
  6. Measure isolator restraint clearance.
  7. Measure isolator deflection.
  8. Verify snubber minimum clearances.

- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

END OF SECTION



## SECTION 21 11 00

### FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:
  - Section 03 30 00 – CAST-IN-PLACE CONCRETE
  - Section 05 50 00 – METAL FABRICATIONS
  - Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS
  - Section 21 11 19 – FIRE-DEPARTMENT CONNECTIONS
  - Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS
  - Section 22 11 16 – DOMESTIC WATER PIPING
  - Section 28 31 11 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM
  - Section 31 20 00 – EARTHWORK

### 1.3 SUMMARY:

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and the following:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-suppression specialty valves.
  - 3. Alarm devices.

### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  - 2. Include diagrams for power, signal, and control wiring.

### 1.5 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 reports.

### 1.6 QUALITY ASSURANCE:

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
  - 2. 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, by a qualified testing agency, and marked for intended location and application.
- D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

#### 1.7 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.

#### 1.8 PROJECT CONDITIONS:

- A. Interruption of Existing Fire-Suppression Water-Service Piping: 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 Engineer no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without **Engineer's** written permission.

## PART 2 - PRODUCTS

### 2.1 DUCTILE-IRON PIPE AND FITTINGS:

- A. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

### 2.2 SPECIAL PIPE FITTINGS:

- A. Ductile-Iron Deflection Fittings:
  1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  2. Pressure Rating: 250 psig minimum.

### 2.3 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.

### 2.4 CURB VALVES:

- A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
  1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

## 2.5 BACKFLOW PREVENTERS:

### A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Ames Fire & Waterworks, Apollo Flow Control, and Watts.
2. Standard: ASSE 1013 or AWWA C511.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
5. Size: As shown on drawings.
6. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

### B. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

## 2.6 ALARM DEVICES:

- A. General: UL 753 and FM Global's "Approval Guide" listing, 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 two 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.

## PART 3 - EXECUTION

### 3.1 EARTHWORK:

- A. Comply with excavating, trenching, and backfilling requirements in Section 31 20 00 – EARTHWORK.

### 3.2 PIPING INSTALLATION:

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- B. Make connections larger than NPS 2 with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve according to MSS S-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. Comply with NFPA 24 for fire-service-main piping materials and installation.
- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- E. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
  - 1. Under Driveways: With at least 36 inches of cover over top.
  - 2. Under Railroad Tracks: With at least 48 inches of cover over top.
  - 3. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.
- F. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- G. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
  - 1. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- H. 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.

- I. Comply with requirements in Section 21 13 13 – WET-PIPE SPRINKLER SYSTEMS, and Section 21 13 16 – DRY-PIPE SPRINKLER SYSTEMS for fire-suppression-water piping inside the building.
- J. Comply with requirements in Section 22 11 16 – DOMESTIC WATER PIPING for potable-water piping inside the building.
- K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.

### 3.3 JOINT CONSTRUCTION:

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in tubing NPS 2 and smaller.
- C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of tubes and remove burrs.
- E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- J. Do not use flanges or unions for underground piping.

### 3.4 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. Pipe clamps and tie rods.

### 3.5 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-Listed or FM Global-Approved 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-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

### 3.6 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.

### 3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION:

- A. Install ball drip valves at each check valve for fire-department connection to mains.



- B. Install protective pipe bollards on two sides of each freestanding fire-department connection. Pipe bollards are specified in Section 05 50 00 – METAL FABRICATIONS.

### 3.8 CONNECTIONS:

- A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.
- B. Connect fire-suppression water-service piping to interior fire-suppression piping.

### 3.9 FIELD QUALITY CONTROL:

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. 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.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one 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.
- D. Prepare test and inspection reports.

### 3.10 IDENTIFICATION:

- A. Install continuous underground warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 – EARTHWORK.

### 3.11 CLEANING:

- A. Clean fire-suppression water-service piping as follows:
  - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
  - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it 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 it to stand for three 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.

### 3.12 PIPING SCHEDULE:

- A. Underground fire-suppression water-service piping NPS 4 shall be the following:
  1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
- B. Underground fire-suppression water-service piping NPS 6 to NPS 12 shall be the following:
  1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
- C. Aboveground fire-suppression water-service piping NPS 3 and NPS 4 shall be the following:
  1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
- D. Aboveground fire-suppression water-service piping NPS 5 to NPS 12 shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

### 3.13 VALVE SCHEDULE:

- A. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be the following:
  1. 175-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves.
- B. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 175-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

- C. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 and larger shall be the following:
  - 1. 175-psig, UL-listed or FM Global-approved, iron, OS&Y gate valves.
- D. Fire-suppression water-service check valves NPS3 and larger shall be the following:
  - 1. UL-listed or FM Global-approved detector check valves.

END OF SECTION

## SECTION 21 11 19

### FIRE-DEPARTMENT CONNECTIONS (FILED SUB-BIDS REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:
  - Section 03 30 00 – CAST-IN-PLACE CONCRETE
  - Section 05 50 00 – METAL FABRICATIONS

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Flush-type fire-department connections.

##### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

## PART 2 - PRODUCTS

### 2.1 STORZ FLUSH-TYPE FIRE-DEPARTMENT CONNECTION:

- A. Available Manufacturers:
  - 1. Fire Protection Products, Inc.
  - 2. Guardian Fire Equipment, Inc.
  - 3. Potter Roemer LLC
- B. Standard: UL 405.
- C. Type: Storz Flush, for wall mounting.
- D. Pressure Rating: 175 psig minimum.
- E. Body Material: Corrosion-resistant metal.
- F. Inlet: Female inlet with 4" Storz connection with Individual self-closing clappers.
- G. Caps: Brass, lugged type, with gasket and chain.
- H. Escutcheon Plate: Rectangular, brass, wall type.
- I. Body Style: Horizontal.
- J. Outlet Location: Back.
- K. Escutcheon Plate Marking: Similar to "AUTO SPKR."
- L. Finish: Rough chrome plated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.
- B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. Install wall-type fire-department connections.
- B. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION

## SECTION 21 13 13

### WET-PIPE SPRINKLER SYSTEMS (FILED SUB-BIDS REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:

Section 01 40 00 – QUALITY REQUIREMENTS

Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS

Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

Section 21 05 48 – VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

Section 21 11 19 – FIRE-DEPARTMENT CONNECTIONS

Section 22 11 16 – DOMESTIC WATER PIPING

Section 22 05 23 - GENERAL-DUTY VALVES FOR FIRE-PROTECTION PIPING

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinklers.
  - 4. Alarm devices.

5. Manual control stations.
6. Pressure gages.

#### 1.4 DEFINITIONS:

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

#### 1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems.
  1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For wet-pipe sprinkler 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.

#### 1.6 INFORMATIONAL SUBMITTALS:

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Domestic water piping.
  2. Sanitary waste and vent piping.
  3. Rainwater piping.
  4. Compressed Nitrogen piping.
  5. HVAC hydronic piping
  6. HVAC duct work piping.
  7. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.



- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

#### 1.8 MAINTENANCE MATERIAL SUBMITTALS:

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

#### 1.9 QUALITY ASSURANCE:

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS:

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer to design wet-pipe sprinkler systems. Refer to Drawing FP000 for Fire Protection design criteria.
  - 1. System design was based on a flow test performed by the Town Water Department on January 28, 2025, using flow and gauge hydrants located on Industrial Road. The flow test result was as follows
    - a. Static Pressure: 45 psi
    - b. Residual Pressure: 37 psi
    - c. Flow: 1034 GPM
    - d. Available Flow at 20 PSI: 1913 GPM
  - 2. The sprinkler system design shall be approved by authorities having jurisdiction.
  - 3. Sprinkler Occupancy Hazard Classifications:
    - a. Offices Areas: light Hazard.
    - b. FP/Water Room, wash bay and fleet storage: Ordinary Hazard Group 1.
    - c. Vehicle Maintenance, Wash Bay, Shops, Parts Storage: Ordinary Hazard Group 2.
    - d. Fluid Room: Extra Hazard group 1.
  - 4. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - 5. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
    - b. Ordinary Hazard Occupancy Group 1: 0.15 gpm over 1500-sq. ft.
    - c. Ordinary Hazard Occupancy Group 2: 0.2 gpm over 1500-sq. ft.
    - d. Extra Hazard Occupancy Group 2: 0.3 gpm over 2500-sq. ft.
  - 6. Maximum Protection Area per Sprinkler:

- a. Light Hazard: 225 sq. ft.
  - b. Ordinary Hazard: 130 sq.ft
  - c. Extra Hazard: 100 sq.ft
7. Total Combined Hose-Stream Demand Requirement: According to 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.
  - c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

## 2.2 STEEL PIPE AND FITTINGS:

- A. Schedule 40 Galvanized and Black-Steel Pipe: ASTM A 53/A 53M, Type E Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Galvanized and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Galvanized and Uncoated Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch-thick.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- G. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Available Manufacturers:
    - a. Anvil International
    - b. Tyco Fire Products
    - c. Victaulic Company
  - 2. Pressure Rating: **175-psig** minimum.
  - 3. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. 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.

## 2.3 SPECIALTY VALVES:

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
  1. Available Manufacturers:
    - a. Reliable Automatic Sprinkler
    - b. Tyco Fire Products
    - c. Victaulic Company
    - d. Viking Corporation
  2. Standard: UL 193.
  3. Design: For horizontal or vertical installation.
  4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
  5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
  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.
- G. Automatic (Ball Drip) Drain Valves:
  1. Available Manufacturers:
    - a. Reliable Automatic Sprinkler
    - b. Tyco Fire Products
  2. Standard: UL 1726.
  3. Pressure Rating: 175-psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4.
  6. End Connections: Threaded.

## 2.4 SPRINKLER PIPING SPECIALTIES:

### A. Branch Outlet Fittings:

1. Available Manufacturers:
  - a. Anvil International
  - b. Tyco Fire Products
  - 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: Dimensions 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. Available Manufacturers:
  - a. AGF Manufacturing Inc.
  - b. Reliable Automatic Sprinkler
  - c. Tyco Fire Products
  - d. Victaulic Company
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "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. Available Manufacturers:
  - a. AGF Manufacturing Inc.
  - b. Tyco Fire Products
  - c. Victaulic Company
  - d. Viking Corporation
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "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. Available Manufacturers:
  - a. Flexhead Industries, Inc.
  - b. Victaulic Company
2. Standard: UL 1474.
3. Type: 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.

## 2.5 SPRINKLERS

- A. Available Manufacturers:
  1. Globe Fire Sprinkler Corporation
  2. Reliable Automatic Sprinkler
  3. Tyco Fire Products
  4. Victaulic Company
  5. Viking Corporation
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- D. Automatic Sprinklers 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.
- E. Sprinkler Finishes: Chrome plated and painted.
- F. 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.
- G. Sprinkler Guards:
  1. Available Manufacturers:
    - a. Reliable Automatic Sprinkler
    - b. Tyco Fire Products
    - c. Victaulic Company
    - d. Viking Corporation
  2. Standard: UL 199.
  3. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.6 ALARM DEVICES:

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
  - 1. Available Manufacturers:
    - a. Potter Electric Signal Company
    - b. Notifier
    - c. System Sensor
  - 2. Standard: UL 464.
  - 3. Type: Vibrating, metal alarm bell.
  - 4. Size: 8-inch minimum diameter.
  - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
  - 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.
- C. Water-Flow Indicators:
  - 1. Available Manufacturers:
    - a. Reliable Automatic Sprinkler Company
    - b. Tyco Fire Products
    - c. Viking Corporation
  - 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. Pressure Switches:
  - 1. Available Manufacturers:
    - a. Potter Electric Signal Company
    - b. Notifier
    - c. System Sensor
  - 2. Standard: UL 346.
  - 3. Type: Electrically supervised water-flow switch with retard feature.
  - 4. Components: Single-pole, double-throw switch with normally closed contacts.
  - 5. Design Operation: Rising pressure signals water flow.
- E. Valve Supervisory Switches:

1. Available Manufacturers:
  - a. Potter Electric Signal Company
  - b. Notifier
  - c. System Sensor
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
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.

## 2.7 PRESSURE GAGES:

- A. Available Manufacturers:
  1. AGF Manufacturing
  2. Ashcroft Inc.
  3. WIKA Instrument Corporation
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250-psig minimum.
- E. Label: Include "WATER" label on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION:

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 SERVICE-ENTRANCE PIPING:

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow



preventers in Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING.

- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### 3.3 PIPING INSTALLATION:

- 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 authorities having jurisdiction. File written approval with Architect 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 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use 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 according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- 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 outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.

#### 3.4 JOINT CONSTRUCTION:

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. 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 according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.5 VALVE AND SPECIALTIES INSTALLATION:

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### 3.6 SPRINKLER INSTALLATION:

- A. Install sprinklers in suspended ceilings in the center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendant 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.

### 3.7 IDENTIFICATION:

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### 3.8 FIELD QUALITY CONTROL:

- A. Perform the following tests and inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance".
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. The sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.9 CLEANING:

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### 3.10 DEMONSTRATION:

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

### 3.11 PIPING SCHEDULE:

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall 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, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 2. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.12 SPRINKLER SCHEDULE:

- A. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
  - 3. Wall Mounting: Sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  - 2. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, humidity, chemicals, or other corrosive fumes.

END OF SECTION

## SECTION 21 13 16

### DRY-PIPE SPRINKLER SYSTEMS (FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

##### 1.2 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. Related Sections:

Section 01 40 00 – QUALITY REQUIREMENTS

Section 21 00 50 –BASIC FIRE SUPPRESSION REQUIREMENTS

Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

Section 21 11 19 – FIRE-DEPARTMENT CONNECTIONS

Section 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

Section 21 05 48 – VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinkler specialty pipe fittings.

4. Alarm devices.
5. Nitrogen Generator.
6. Control panel
7. Pressure gages.
8. Painting of sprinkler piping.

#### 1.4 DEFINITIONS:

- A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

#### 1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For dry-pipe sprinkler systems.
  1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For dry-pipe sprinkler 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.

#### 1.6 INFORMATIONAL SUBMITTALS:

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Domestic water piping.
  2. Sanitary waste and vent piping.
  3. Rainwater piping.
  4. Compressed Nitrogen piping.
  5. HVAC hydronic piping
  6. HVAC duct work piping.
  7. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.

8. Qualification Data: For qualified Installer and professional engineer.

- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Welding certificates.
- D. Fire-hydrant flow test report.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- F. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS:

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for a minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.9 QUALITY ASSURANCE:

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.



## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTIONS:

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed nitrogen. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

### 2.2 PERFORMANCE REQUIREMENTS:

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

- 1. NFPA 13.

- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

- C. Delegated Design: Engage a qualified professional engineer to design dry-pipe sprinkler systems. Refer to Drawing FP000 for Fire Protection design criteria.

- 1. System design was based on a flow test performed by the Town Water Department on January 28, 2025, using flow and gauge hydrants located on Industrial Road. The flow test result was as follows

- a. Static Pressure: 45 psi
- b. Residual Pressure: 37 psi
- c. Flow: 1034 GPM
- d. Available Flow at 20 PSI: 1913 GPM

- 2. The sprinkler system design shall be approved by authorities having jurisdiction.

- 3. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

- 4. Sprinkler Occupancy Hazard Classifications:

- a. Vehicle Storage: Ordinary Hazard Group 2.

- 5. Minimum Density for Automatic-Sprinkler Piping Design:

- a. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft.
- b. The square foot above shall be increased by 30% for dry sprinkler systems.

- 6. Maximum Protection Area per Sprinkler:
  - a. Ordinary-Hazard Occupancy: 130 sq. ft.
- 7. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
  - a. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

### 2.3 STEEL PIPE AND FITTINGS:

- A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated Couplings: ASTM A 865/A 865M, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Cast-Iron Flanges: ASME 16.1, Class 125.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch-thick.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
- H. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Available Manufacturers:
    - a. Anvil International
    - b. Tyco Fire Products
    - c. Victaulic Corporation
  - 2. Pressure Rating: 175-psig minimum.

3. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. 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.

#### 2.4 SPECIALTY VALVES:

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Dry-Pipe Valves:
  1. Available Manufacturers:
    - a. Reliable Automatic Sprinklers
    - b. Tyco Fire Products
    - c. Victaulic Company
    - d. Viking Corporation
  2. Standard: UL 260.
  3. Design: Differential-pressure type.
  4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
- G. Automatic (Ball Drip) Drain Valves:
  1. Available Manufacturers:
    - a. Reliable Automatic Sprinkler
    - b. Tyco Fire Products
  2. Standard: UL 1726.
  3. Pressure Rating: 175-psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4.

6. End Connections: Threaded.

## **2.5 NITROGEN GENERATOR**

- A. Furnish and install a nitrogen generator at each fire sprinkler riser to service all dry zones as required.
- B. The Nitrogen Generator system shall include:
  - 1. Integrated Lubricated Fire Protection Air Compressor shall be sized appropriately for the application and capable of achieving system air pressure within 30 minutes in accordance with NFPA 13.
  - 2. Air compressors shall be capable of producing continuous volume of compressed air that is sufficient to meet design requirements of the dry system. When multiple risers are used the compressor must be sized to handle the combined flow and pressure requirements of all system risers.
- C. Automatic Drain Valve: The drain valve shall be capable of removing all liquid moisture from the air storage tank and nitrogen pre-filters.
- D. The nitrogen membrane shall be capable of producing a minimum of 98% nitrogen.
- E. UL Listed Air Maintenance Device: the air maintenance device shall be equipped with an adjustable air regulator that is capable of setting the required pressure for the sprinkler system.
- F. Air Filtration: The air filtration shall include a 5 micron filter and a coalescing filter.
- G. Nitrogen Control Panel: the nitrogen control panel shall include run time monitor with excess runtime alarm. The panel shall have an audible alarm and visual indication. The panel shall be UL 508A. The panel shall be capable of tying into the fire alarm system to provide trouble and alarm signals.
- H. Bypass Alarm: the alarm shall monitor the bypass valve in the nitrogen cabinet.
- I. Air Storage Tank and Nitrogen Tank shall conform to ASME standard for pressure vessels.
- J. Nitrogen Analyzer: A portable analyzer shall be provided which will be battery operated and able to be used to obtain nitrogen purity readings.
- K. Each dry sprinkler system shall be provided with an Inspectors Gas Analyzer Port to monitor the 98% or greater nitrogen purity throughout the system.



## 2.6 SPRINKLER PIPING SPECIALTIES:

- A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.
- B. Flow Detection and Test Assemblies:
  - 1. Available Manufacturers:
    - a. AGF Manufacturing Inc.
    - b. Reliable Automatic Sprinkler
    - c. Tyco Fire Products
    - d. Victaulic Company
  - 2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "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.
- C. Branch Line Testers:
  - 1. Available Manufacturers:
    - a. Elkhart Brass Manufacturing Co.
    - b. Fire End and Crocker Corporation
    - c. Potter Roemer LLC
  - 2. Standard: UL 199.
  - 3. Pressure Rating: 175-psig minimum.
  - 4. Body Material: Brass.
  - 5. Size: Same as connected piping.
  - 6. Inlet: Threaded.
  - 7. Drain Outlet: Threaded and capped.
  - 8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
  - 1. Available Manufacturers:
    - a. AGF Manufacturing Inc.
    - b. Viking Corporation
    - c. Tyco Fire Products
    - d. Victaulic Company
  - 2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "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.

## 2.7 SPRINKLERS:

### A. Available Manufacturers:

1. Reliable Automatic Sprinkler
2. Tyco Fire Products
3. Victaulic Corporation
4. Viking Corporation

### B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

### C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

### D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

### E. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. 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.

### F. Sprinkler Finishes: Chrome plated.

### G. 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.

### H. Sprinkler Guards:

#### 1. Available Manufacturers:

- a. Reliable Automatic Sprinkler
- b. Tyco Fire Products
- c. Victaulic Corporation
- d. Viking Corporation

#### 2. Standard: UL 199.

#### 3. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.8 ALARM DEVICES:

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Available Manufactures:

- a. Notifier
- b. Potter Electric Signal Company
- c. System Sensor

2. Standard: UL 464.

3. Type: Vibrating, metal alarm bell.

4. Size: 8-inch minimum diameter.

5. Finish: Red-enamel factory finish, suitable for outdoor use.

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.

C. Pressure Switches:

1. Available Manufacturers:

- a. System Sensor
- b. Potter Electric Signal Company
- c. Notifier

2. Standard: UL 346.

3. Type: Electrically supervised water-flow switch with retard feature.

4. Components: Single-pole, double-throw switch with normally closed contacts.

5. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:

1. Available Manufacturers:

- a. System Sensor
- b. Potter Electric Signal Company
- c. Notifier

2. Standard: UL 346.

3. Type: Electrically supervised.

4. Components: Single-pole, double-throw switch with normally closed contacts.

5. Design: Signals that controlled valve is in other than fully open position.

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

## 2.9 PRESSURE GAGES:

- A. Available Manufacturers:
  - 1. Terice
  - 2. Ashcroft Inc.
  - 3. WIKA Instrument Corporation
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0- to 250-psig minimum.
- E. Label: Include "WATER" or "AIR/WATER" label on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION:

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 SERVICE-ENTRANCE PIPING:

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### 3.3 PIPING INSTALLATION:

- 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 authorities having jurisdiction. File written approval with Engineer 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 requirements for installation of sprinkler piping.
  - C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
  - D. Use 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 according to NFPA 13.
  - H. Install sprinkler piping with drains for complete system drainage.
  - 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 outside building.
  - K. Install alarm devices in piping systems.
  - L. Install all interconnecting piping between the nitrogen storage tank and the sprinkler risers to allow adequate nitrogen supply to all risers.
  - M. Install Inspectors Gas Analyzer port at the furthest point from the sprinkler riser for each sprinkler riser.
  - N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
  - O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.

- P. Drain dry pipe sprinkler system.
- Q. Pressurize and check dry pipe sprinkler system piping and nitrogen generator.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS.
- U. Field painting and finishing shall conform to the requirements specified in Section 09 96 00 – HIGH PERFORMANCE INDUSTRIAL COATINGS.

#### 3.4 JOINT CONSTRUCTION:

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. 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 according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.5 VALVE AND SPECIALTIES INSTALLATION:

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install dry valves in vertical position, in proper direction of flow, and in main supply to dry system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### 3.6 SPRINKLER INSTALLATION:

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- 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.

### 3.7 IDENTIFICATION:

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and Section 21 00 50 – BASIC FIRE SUPPRESSION REQUIREMENTS.

- C. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### 3.8 FIELD QUALITY CONTROL:

- A. Perform the following tests and inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Start and run nitrogen 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.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.9 CLEANING:

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### 3.10 DEMONSTRATION:

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

### 3.11 PIPING SCHEDULE:

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.



- C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall 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, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- D. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.12 SPRINKLER SCHEDULE:

- A. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Rooms with Suspended Ceilings: Dry pendent, recessed, flush, and concealed sprinklers as indicated.
  - 3. Wall Mounting: Dry sidewall sprinklers.
  - 4. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  - 2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  - 3. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated were exposed to acids, chemicals, humidity, or other corrosive fumes.

END OF SECTION

SECTION 21 31 13  
ELECTRIC-DRIVE, VERTICAL TURBIAN FIRE PUMP  
(FILED SUB-BIDS REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – FIRE SUPPRESSION SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 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. Related Sections:

Section 01 40 00 – QUALITY REQUIREMENTS

Section 21 00 50 – BASIC FIRE-SUPPRESSION REQUIREMENTS

Section 21 05 48 – VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

Section 21 11 19 – FIRE-DEPARTMENT CONNECTIONS

Section 22 11 16 – DOMESTIC WATER PIPING

Section 23 05 23 - GENERAL-DUTY VALVES FOR FIRE-PROTECTION PIPING

1.3 SUMMARY

- A. Section includes vertical-turbine fire pumps, accessories, and specialties:

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
  - 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.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fire 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.
- B. Product Certificates: For each type of fire pump, from manufacturer.
- C. Source quality-control reports.
- D. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data: For fire pumps to include in operation and maintenance manuals.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Comply with NFPA 20.
- B. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Component Importance Factor: 1.5.
- C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum.

- D. 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 ASSEMBLY DESCRIPTION

- A. Description: Factory-assembled and -tested fire-pump and driver unit.
- B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

## 2.3 VERTICAL-TURBINE FIRE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Peerless Pump Company, A Quinn Fire Pump, Inc company.
  - 2. Patterson Pump Company.
  - 3. A-C Fire Pump; a Xylem brand.
  - 4. Or equivalent.

### Fire Pump Unit Description:

Provide and install, where indicated on the drawings, a complete vertical turbine fire pump assembly in full compliance with NFPA 20 and applicable UL/FM requirements. The pumping unit shall be factory assembled, aligned, and hydrostatically tested prior to shipment, and furnished complete with all required accessories for proper installation and operation. The pump shall be of vertical turbine, multistage design, with all components constructed to withstand the maximum operating pressures specified for the system. The discharge head shall be machined to ensure accurate alignment with the driver and provided with a steel soleplate where required. The vertical turbine fire pump shall be furnished with a vertical hollow-shaft electric motor driver equipped with a non-reverse ratchet and listed for fire-pump service. The final column length and bowl setting shall be verified in the field by the installing contractor in coordination with and as recommended by the pump manufacturer to ensure proper suction submergence and hydraulic performance.

- B. Pump Head: Cast iron, for surface discharge.
  - 1. Discharge Outlet: Flanged with flanges complying with ASME B16.1; except connections may be threaded according to ASME B1.20.1, in sizes where flanges are not available.
  - 2. Pump Head Seal: Stuffing box and packing.
  - 3. Base: Cast iron or steel with hole for electrical cable.
- C.

D. Pump:

1. Standard: UL 448 for vertical-turbine pumps for fire service.
2. Discharge Head: High profile, Shall be ASTM A48 Class 30 cast iron, one-piece construction round base. The top of the discharge head shall be machined with a rabbet fit to facilitate alignment of the motor and pump shaft. The height of the discharge head shall permit coupling the line shaft to the drive shaft above the stuffing box. The outlet flange shall be 125-pound ANSI standard flat face. The pump shall be set on a steel soleplate as provided by the pump manufacturer, if required
3. Stuffing Box: An ASTM A48, Class 30 cast iron stuffing box shall be provided containing an ASTM B505-836, bronze bearing, graphite impregnated packing with a bleed-off connection and grease lubricating connection to a lantern ring. A bronze, split type packing gland shall be employed.
4. Line Shaft: Synthetic rubber, grooved, water lubricated bearings shall be used. The bearing shall be held in place by a bronze retainer.
5. Line Shaft Bearings: Is to be furnished at each bowl assembly and shall be a combination neoprene and bronze construction. Coordinate required length of shaft with manufacture based on the selected pump model.
6. Bowl Section: ASTM A48 Class 30 cast iron, designed for maximum efficiency and long life. Pump shall consist of suction nozzle, bowl assembly and discharge case for connecting to the discharge column pipe. Bowls shall have a lateral seal ring or incorporate impeller wear rings. All bowl hardware shall be SS.
7. Impeller: ASTM B584 bronze, enclosed type with non-overloading characteristics. All water passages shall be smooth surfaces. Impellers shall be securely fastened to the bowl to pump shaft by means of collets that are ASTM A582, 303SS.
8. Suction Bell: Close-grained cast-iron bowl with bronze bearing and bronze sand collar.
9. Wear Rings: Located in the suction and intermediate bowls and with minimum clearance to the surface of the impeller.
10. Column Pipe: ASTM A53/A53M, Schedule 40, galvanized-steel pipe with threaded sleeve couplings, rabbet fit flange or flange connections.
11. Suction Strainer: Cast or fabricated; bronze or stainless steel and sized to restrict passage of 0.5-inch diameter objects.
12. Air Release: The fire pump shall be complete with 3-1/2" dial discharge gauge, air release valve assembly.

E. Driver:

1. Standard: UL 1004A.
2. Type: Electric motor
3. Mounting: On pump head above pump.

F. Capacities and Characteristics:

1. Rated Capacity: 500 gpm.
2. Total Rated Head: 85 psig
3. Inlet Column Size: 6 inches

4. Pump Column Length: As required by the manufacturer for the specified model.
5. Pump Head Outlet Flange: Class 125
6. Motor Horsepower: 40 hp.
7. Motor Speed: 1760 rpm.
8. Electrical Characteristics:
  - a. Volts: 460V.
  - b. Phase: Three.
  - c. Hertz: 60.
9. Pump-Start, Pressure-Switch Setting: In accordance with NFPA 20 and the manufacturer's recommendations.
10. Pump-Stop, Pressure-Switch Setting: In accordance with NFPA 20 and the manufacturer's recommendations.

## 2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

- A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump discharge piping.
- B. Hose Valve Manifold Assembly:
  1. Standard: Comply with requirements in NFPA 20.
  2. Header Pipe: ASTM A53/A53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
  3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
  4. Automatic Drain Valve: UL 1726.
  5. Manifold:
    - a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
    - b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
    - c. Escutcheon Plate: Brass or bronze; round.
    - d. Exposed Parts Finish: Chrome plated
    - e. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

## 2.5 GROUT

- A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
  - 1. Verification of Performance: Rate fire pumps according to UL 448.
- B. Fire pumps will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
  - 1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- C. Install fire-pump discharge piping equal to or larger than size required by NFPA 20.
- D. Support piping and pump separately, so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."
- F. Install pressure gage on pump-head discharge flange pressure-gage tapping. Comply with requirements for pressure gages specified in Section 211313 "Wet-Pipe Sprinkler Systems."
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- I. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

### 3.2 ALIGNMENT

- A. Align pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connection.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 2.4 and to tolerances specified by manufacturer.
- E. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems". Drawings indicate general arrangement of piping, fittings, and specialties.
- F. Install piping adjacent to pumps and equipment to allow service and maintenance.
- G. Connect relief-valve discharge to drainage piping or point of discharge.
- H. Connect fire pumps to their controllers.
- I. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

### 3.3 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 262933 "Controllers for Fire-Pump Drivers."
- B. Perform the following tests and inspections with the of a factory-authorized service representative.
  - 1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
  - 2. Test according to NFPA 20 for acceptance and performance testing.
  - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.



- E. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

### 3.4 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup check according to manufacturer's written instructions.
  - 2. Start up: The pump manufacturer shall, prior to shipment, assemble, connect, and perform a complete operational test of the fire pump assembly to verify proper performance. The manufacturer shall furnish the services of a factory-trained representative to attend the initial startup and final acceptance testing at the project site. The controller manufacturer shall have an established local sales and service organization with a minimum of ten (10) years of experience supporting their product line, providing 24/7 service availability and adequate spare parts inventory. Prior to shipment, the controller manufacturer shall fully wire and test the jockey pump controller assembly, verifying all operating functions including manual and automatic start/stop and minimum run timing. A factory-trained controller representative shall be present during the initial startup and final acceptance tests. Coordination of the final acceptance test with the underwriting authorities shall be the responsibility of the installing contractor.

### 3.5 WARRANTY

The pump and controller manufacturers shall warrant all components against defects in workmanship and material for a period of 12 months from the time of substantial completion.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213213

SECTION 22 00 01

PLUMBING FILED SUB-BID REQUIREMENTS  
(FILED SUB-BID)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

- A. Division 0- Procurement and Contracting Requirements, and Division 1- General Requirements, including. The Instructions to Bidders, Form of General Bid, Form for Sub-Bid, Agreement, Subcontract Form, General and Supplementary Conditions and complete specification are hereby made a part of these Specifications and Subcontractor shall consult them in detail for instructions.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public contract Law – Chapter 30.
- C. Specification requirements for the Filed Sub-Bid PLUMBING include the following listed specification sections in their entirety:

22 00 01  
22 00 50  
22 05 13  
22 05 19  
22 05 23  
22 05 29  
22 05 48  
22 07 19  
22 08 00  
22 11 16  
22 11 19  
22 11 22  
22 11 23  
22 13 16  
22 13 19  
22 13 20  
22 13 23  
22 14 13  
22 14 23

22 15 13  
22 15 19  
22 33 00  
22 42 00  
22 45 00

- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

P001  
P101  
P102  
P103  
P111  
P112  
P113  
P114  
P115  
P121  
P122  
P123  
P401  
P402  
P501  
P502  
P503  
P601  
P701  
P702

- E. Examine all Drawings and all other Sections of the project manual for requirements therein affecting Work of this Filed Subcontract.
- F. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure steady progress of all work under Contract. This coordination requires familiarization with installation conditions shown on the following Contract Drawings:

G. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Owner at a time and place as stipulated in Sections 00100 Advertisement for Bids and 00200 Instructions to Bidders.

1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER: \_\_\_\_\_

SUB-BID FOR TRADE: PLUMBING

2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by the Owner, as bound herein, accompanied by the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of five (5) percent of the Filed Sub-Bid.

G. SUB-SUB BIDDERS:

The following items will be broken out on the Sub-Bid Form if the Sub-Bidder does not self-perform.

Plumbing Piping Insulation 22 07 19

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

## SECTION 22 00 50

### BASIC PLUMBING REQUIREMENTS (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 – GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 SUMMARY:

- A. The work of Division 22 is governed by the General and Supplementary Conditions of the Contract, and Sections of Division 1 of the Project Manual.
- B. Perform work and provide materials and equipment as shown on Drawings and as specified or referenced in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide complete and fully functional systems installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and backcharges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the Contract Documents.
- D. Section Includes: The work of this Section includes the basic requirements common to the PLUMBING Sections of Division 22, including:
  - 1. Definitions.
  - 2. Organization of submittals.
  - 3. Proposed substitutions.
  - 4. Warranty.
  - 5. Manuals and Instructions.
  - 6. Record documents.

7. Sleeves and penetrations.
  8. Equipment and piping identification.
  9. Core Drilling.
  10. Cutting and Patching.
  11. Scaffolding, hoisting, rigging and staging.
  12. System Startups.
- E. Related Sections: Related work specified in other Sections includes, but is not necessarily limited to:
1. Section 01 33 23 – Submittals.
  2. Section 01 33 23.23 – Submittal of Operation and Maintenance Manuals.
  3. Section 01 73 29 - Cutting and Patching: Openings in masonry, concrete, tile, and other parts of structure, except drilling for hangers, providing holes and openings in metal decks, and core drilling.
  4. Section 01 92 13 – Operations and Maintenance Manuals.
  5. Section 05 50 00 - Metal Fabrications: Structural supports necessary to distribute loading from equipment to roof, floor, walls or other building structural components.
  6. Section 07 62 00 - Sheet Metal Flashing and Trim.
  7. Section 07 84 43 – Joint Firestopping: Caulking of pipe penetrations through floor slabs and fire-rated or smoke partitions.
  8. Section 07 92 00 – Joint Sealants: Sealing joints between plumbing fixtures and abutting surfaces.
  9. Section 09 90 00 – Painting: Painting of exposed piping and equipment except as specified in this Section.
  10. Division 23 - HVAC
  11. Division 26 - Electrical.

12. Division 31 - Earthwork

13. Division 33 - Utilities

### 1.3 REFERENCES:

A. American National Standards Institute (ANSI)

1. ANSI A13.1 - Scheme for the Identification of piping systems.

B. American Society of Mechanical Engineers (ASME)

1. ASME 2019 Boiler and Pressure Vessel code Section VIII, Rules for Construction of Pressure Vessels.

C. ASTM International (ASTM)

1. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops.

D. Compressed Gas Association (CGA)

1. C-9 - Standard Color Marking of Compressed Gas Cylinders Intended for Medical Use.

E. Construction Specifications Institute. (CSI)

1. Manual of Practice

F. Underwriters Laboratories (UL)

1. Fire Resistance Directory, Vol. I - Beams, Columns, Floors, Roofs, Walls, and Partitions.
2. Fire Resistance Directory, Vol. II, Through Penetration Firestop Systems.
3. ANSI/UL1479 - Fire Tests of Through Penetration Firestops.

G. National Fire Protection Association

1. No. 241-Safeguarding Construction, Alteration, and Demolition Operations.

H. Code of Massachusetts Regulations (CMR)

1. 248 CMR Massachusetts State Fuel Gas and Plumbing Code.

The materials, products, devices, methods, systems, design, and installation of any and all aspects of a plumbing system shall be in conformance with 248 CMR 3.00 through 10, including that all products used in any plumbing or gas fitting system shall be Product - Approved by the board of State Examiners of Plumbing and Gas Fitters.

2. 522 CMR Massachusetts Board of Boiler Rules

3. 527 CMR Massachusetts Board of Fire Protection Regulations.

4. 780 CMR Massachusetts State Building Code.

1.4 DEFINITIONS:

A. General: Words and terminology used throughout the PLUMBING Sections of Division 22 shall be understood in their common usage as defined in a common dictionary, and as further defined in the CSI Manual of Practice, the General and Supplemental Conditions of the Contract, Division 1 of the Project Manual, and the Sections of Division 22.

B. Specification Content: The PLUMBING Specification Sections in Division 22 may use certain conventions regarding the style 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:

1. Abbreviated Language: Language used in Specifications and other Contract Documents maybe of the abbreviated style. Words and meanings shall be interpreted as appropriate. Words implied, but not stated shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Streamlined Language: The Specifications generally use the imperative mood and streamlined language. Requirements expressed in the imperative mood shall be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.



- A. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.
- C. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited.
- D. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Engineers, requested by the Architect, and similar phrases.
- E. Approved: When used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, the term "approved," is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- F. Furnish: Furnish means purchase, delivery and storage at the Project Site for installation under other Sections or by the Owner.
- G. Install: Includes operations at the Project Site including the actual unpacking, preparation, assembly, erecting, placing, anchoring, supporting, connecting, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations required for a complete installation ready for the intended use.
- H. Provide: Provide means to furnish and install.
- I. Project Site: Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work 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 on which the Project is to be built.
- J. Testing Agencies: A testing agency 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.
- K. Product Data: Product data sheets include the manufacturers' standard catalog information with illustrations, standard schedules, diagrams, performance charts, instructions, and brochures that illustrate physical appearance, size, weight, and other general characteristics of materials and equipment for some portion of the work.

- L. Shop Drawings: Shop drawings are detailed drawings, diagrams, illustrations, and schedules specifically prepared by the installing contractor or supplier to illustrate some portion of the work.
- M. Fabrication Drawings: The installation shop drawings required by the work of the various Sections of the Project Manual, such as sheet metal and sprinkler shop drawings, and normally prepared by the installing sub-contractor.
- N. Coordination Drawings: The coordinated installation shop drawings normally prepared by the installing sub-contractors indicating multiple building systems and interdisciplinary work on a single set of coordinated documents.
- O. Piping: Includes all necessary piping system components, including pipe, fittings, couplings, gaskets, flanges, unions, valves, strainers, hangers, supports, attachments, insulation, and identification.
- P. Substitutions: Substitutions include manufacturers not listed as acceptable within the specifications, or materials, products, systems, or equipment, which differ from the requirements of the Contract Documents.
- Q. Regulations: Regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- R. NRTL: Nationally Recognized Testing Laboratory such as Underwriters Laboratory, Inc. or Factory Mutual Research Corporation.
- S. Life Safety Systems: Life Safety Systems include all fire protection systems, devices, and equipment used to detect fire, activate alarms, suppress or control fire and smoke, or any combination thereof.

#### 1.5 SUBMITTALS:

- A. General Requirements: Comply with pertinent Submittals, the Sections of Division 22 – PLUMBING, and the additional requirements of this Section.
- B. Materials List: Within 30 calendar days after the Contractor has received the Owner's Notice to proceed, submit a list of the proposed materials to be provided under the work of the PLUMBING Sections of Division 22.
- C. Organization of Submittals: Organize submittals into comprehensible packages with related product data sheets and shop drawings organized and identified by Specification Section and Article numbers and titles. Organize submittals into packages in order as specified in the Sections of Division 22. Identify submittal pages to indicate the specific equipment or fixture type the data sheet applies to

by Article number and title. Submittals, which are not properly identified, may be returned without review. Submittals can be submitted electronically as detailed in Section 01 33 23, Submittals.

1. Indicate appropriate model numbers in manufacturers' brochures and cross out non-applicable information.
  2. Copies of faxed pages are unacceptable.
  3. Submit shop drawings for particular systems complete, simultaneously, and organized by system.
- D. Submittal Cover Sheet: Provide a completed cover sheet with each submittal package indicating the information on the following sample page:

| SUBMITTAL COVER SHEET                                                                                            |        |              |
|------------------------------------------------------------------------------------------------------------------|--------|--------------|
| PROJECT:                                                                                                         |        | CONTRACTOR:  |
| SECTION NO.:                                                                                                     |        | ARTICLE NO.: |
| DESCRIPTION:                                                                                                     |        |              |
| CONTRACT DRAWING REFERENCE NO.:                                                                                  |        |              |
| EQUIPMENT IDENTIFICATION TAG NUMBER:                                                                             |        |              |
| SUBMISSION (CIRCLE ONE): FIRST, SECOND, THIRD, FOURTH                                                            |        |              |
| DATE:                                                                                                            |        |              |
| INFORMATION AND CHECKLIST                                                                                        | REPLY  | COMMENTS     |
| 1. Contractor's Log #ID                                                                                          |        |              |
| 2. Name, address, and phone number of supplier.                                                                  |        |              |
| 3. Are all specified or scheduled items included and exactly match scheduled/specified items?                    | Yes No |              |
| 4. Is this item a substitution?                                                                                  | Yes No |              |
| 5. Are deviations clearly identified?                                                                            | Yes No |              |
| 6. Does equipment fit space shown on construction documents, coordination drawings, and actual field conditions? | Yes No |              |
| 7. Has support, erection, weights, and installation been coordinated with all trades?                            | Yes No |              |
| 8. Does the proposed installation void warranties or violate UL or code requirements?                            | Yes No |              |
| 9. Does this material/equipment add expense to any other trade or project costs?                                 | Yes No |              |
| 10. Does equipment require interface with other trades? List sections and specifics requiring coordination?      | Yes No |              |
| 11. Is control interface coordinated?                                                                            | Yes No |              |
| 12. List electrical characteristics (V/Ph/A)                                                                     |        |              |
|                                                                                                                  |        |              |
|                                                                                                                  |        |              |

- E. After approval of the proposed materials list, provide complete submittals as soon as possible and with adequate time for processing in order to not delay the project.
- F. Submit for review of all project specific reproducible drawings, one electronic copy in Portable Document Format (PDF). Submit for review pdfs of detailed Shop Drawings and Product Data. Submittals for review shall include complete Specifications, including type of materials, electrical characteristics, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted including wiring diagrams shall be complete for all equipment and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated using a method that will be visible.
- G. Contractor's Review: Review, stamp and certify each submittal prior to submission to the Architect. The certification shall state that the data and details contained on each Shop Drawing, Product Data, layout drawing, catalog data and brochure has been reviewed and that it complies with the Contract Documents in all respects. Shop Drawings, layout drawings, catalog data and brochures will not be reviewed and will be returned unchecked unless they are certified, and all items specifically identified.
- H. Multiple submissions: It is intended that Submittal data be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit" only one additional submission will be permitted.
  - 1. If the second submission is not acceptable, or if the submittal is not made within the specified time frame, the right of substitution and selection will be lost. At that time the specified item shall be provided at no additional cost.
- I. Required Review Time: A minimum period of **ten** working days, exclusive of transmittal time, will be required in the Engineer's office each time Shop Drawings, Product Data, layout drawings, catalog data and brochures are submitted or resubmitted for review. A minimum period of fifteen working days exclusive of transmittal time will be required for reviewing substitute materials or manufacturer. The required review time, including multiple submission, shall be considered when scheduling the work.
- J. Submit Shop Drawings and Product Data sheets in a timely manner sufficiently in advance to give ample time for reviewing, correcting, resubmitting and re-reviewing if necessary. No claim for delay will be granted for failure to comply with this requirement.
- K. Equipment shall be of proper size for its allotted space. Equipment may be disassembled as required, where it does not invalidate the manufacturer's

warranty, so that it can be installed through available window, door, or louver openings.

- L. Schedule of Shutdowns: After the project construction schedule is developed, submit the following information to the Owner for all required shutdowns of existing systems.
  - 1. Date of proposed shutdown.
  - 2. List of systems to be affected.
  - 3. List of areas affected by the shutdown.
  - 4. Description of work to be performed.
  - 5. Estimated length of the shutdown.
- M. Piping Systems Schedule: Prepare and submit a schedule of PLUMBING piping systems to indicate the piping material, joints, and fittings to be used with each system.
- N. Insulation Schedule: Prepare and submit a schedule to indicate insulation types and thicknesses to be used on each PLUMBING piping system.
- O. UL Through-Penetration Firestop System Schedule: Prepare and submit a schedule to indicate the UL-System number for through-penetration assemblies to be used with all mechanical systems. Coordinate with the work of the Penetrations and Fire Stopping Section in Division 7.
- P. Shop Drawings: Submit product data sheets and shop drawings as specified within the PLUMBING Sections of Division 22.
- Q. Record Drawings: Prepare record drawings in accordance with the provisions of Division 1 governing - Project Record Documents and the additional requirements of this Section.
- R. Valve Tag Charts: Prepare and submit valve tag charts as specified in this Section.
- S. Operation and Maintenance Manuals: Prepare and submit copies of the Operation and Maintenance Manuals as specified in the appropriate Section of Division 1 governing - Contract Close-out. and the additional requirements of this Section.
- T. Training Seminar Confirmation: Prior to the final completion of the project, submit copies of the training seminar sign in sheets and a letter to the Owner containing the names of training seminar participants, including instructor's

names, the name of the firms represented and the dates of the instruction seminars.

- U. Engineer's Action: Except for items submitted solely for record purposes or information, the Engineer will review each submittal for general compliance with the Contract Documents, as defined in the General Conditions, and return the submittal with comments.
- V. Action Stamp: The Engineer will attach a Submittal Review sheet to each submittal package to indicate the status of the submission and the action taken, as follows:
  - 1. Furnish as Submitted: Submission is generally in compliance with the intent of the contract documents and fabrication may be undertaken.
  - 2. Furnish as Noted: Submission is generally in compliance with the contract documents and fabrication may be undertaken with the corrections noted.
  - 3. Revise and Resubmit: Submission is not in compliance with the contract documents and requires substantial corrections. Fabrication work may not be undertaken.
  - 4. Rejected: Submission is not in compliance with the contract documents. Resubmit as specified.
  - 5. Submit Specified Item: Second submission is not in compliance with the contract documents. Submit specified item without deviation.
  - 6. Reviewed for Comment Only: Engineer is not responsible for the approval of the submittal.

#### 1.6 QUALITY ASSURANCE:

- A. Qualifications: Use adequate numbers of skilled, licensed workers who are thoroughly trained and experienced and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Standard of Quality: The manufacturers names specified first or scheduled on the drawings are used for the design and to establish the standards of function, dimension, space requirements, appearance, and quality upon which the Contract is based. Acceptable manufacturers names are listed to provide competitive bids with the specified or scheduled manufacturer.
  - 1. Acceptable Manufacturers: The inclusion of a manufacturer's name within the list of acceptable manufacturers does not necessarily mean that the

manufacturer's standard product is equal to the specified or scheduled product without some required modification. The submitted product shall be equal in terms of quality, durability, appearance, space requirements, weight, strength, and design to the product required by the Contract Documents.

- C. Contractor's Review: It is solely the Contractor's responsibility to verify that the products of acceptable manufacturers and proposed substitutes meet or exceed the performance of the specified or scheduled product. To be considered acceptable, products must comply with the following for the full possible performance range:

1. Horsepower: Equal or less.
2. Efficiency: Equal or greater.
3. Capacities: Equal or greater.
4. Space/Clearances: Equal or greater.
5. Storage and Recovery: Equal or greater.
6. Warranty: Equal or better.
7. Weight: Equal or less.
8. Noise: Equal or quieter.

- D. Substitutions: Substitutions include manufacturers not listed as acceptable within the specifications, or products, systems and methods, which differ from the specified systems.

1. Comply with the provisions of the Instructions to Bidders and pertinent sections in Division 1. Submit list of proposed substitutes for review and approval in compliance with the Instructions to Bidders, AIA Document A701.
2. By the submission of a proposed substitution, the Contractor represents that he has reviewed the proposed substitution and certifies that:
  - A. The proposed substitution does not affect dimensions shown on drawings.
  - B. Changes to the building design, including A/E design and review time at a rate of 2.6 x DPE, detailing and construction costs caused by the requested substitution will be included in the bid price with no additional cost to the Owner.
  - C. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
  - D. Maintenance and service parts are available locally.



- E. All costs associated with or caused by the use of the proposed substitute will be covered by the Contractor.

E. Codes and Regulations:

- 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies and authorities that have jurisdiction.
- 2. In case of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.

F. Qualifications for Welding and Brazing Work:

- 1. Qualify welding processes and welding operators in accordance with AWS Standard Qualification Procedure."
- 2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  - A. If recertification of welders is required, retesting will be Contractor's responsibility.

G. Standards: Maintain copies of the most recent editions of the following standards at the job site for reference during construction:

- 1. UL Through Penetration Fire Stop Systems.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Protection: Use all means necessary to protect materials of the Mechanical Sections before, during and after installation and to protect installed work and materials of all trades and Sections.
- B. Replacements: In the event of damage, immediately make all repairs and replacement necessary to the approval of the Engineer at no change in Contract Sum.

1.8 PROJECT CONDITIONS:

- A. Comply with Project Specification Section 00 21 13, Instructions to Bidders. Visit the site prior to submission of bids and examine existing conditions to be familiar with the related implications to the Work of the PLUMBING Sections.

1. Questions regarding the Bidding Documents: Submit questions and requests for clarifications in compliance with the Instructions to Bidders.
- B. Contract Documents: The Contract Drawings are diagrammatic and do not show every fitting and component and shall be used in conjunction with the specified requirements to provide complete and fully functional systems for the intended use. The drawings and specifications are complimentary, and the requirements indicated on both establish the requirements of the Contract.
  1. The Contract Drawings indicate the general locations of equipment and distribution systems throughout the project. The actual installation locations shall be coordinated by the contractor on site based on actual field measurements performed by the contractor.
- C. Document Review: Review the complete set of Contract Documents and be familiar with the space requirements and work of other Sections. Thoroughly review building sections, architectural details, space availability phasing requirements and mechanical drawings for a complete understanding of the scope and coordination requirements of the PLUMBING Sections.
- D. Scheduled Equipment: Standard manufacturers model numbers scheduled on the drawings shall be modified as specified in the descriptive specification for the scheduled equipment. The drawings generally define quantities, and the specifications further define equipment quality and system components, which may not be included in the standard model number.
- E. Pipe sizing notations: Pipe sizing notations run along the pipe from the larger sizes to the smaller size. Sections of pipe, which are not specifically identified with a pipe size, are the continuation of the previous larger pipe size indication. Pipe sizes change only where indicated by a notation change.
- F. Existing Conditions: The existing conditions indicated on the contract drawings are taken primarily from existing record drawings provided by the Owner and do not necessarily indicate actual as-built conditions. Preparation work of the mechanical and electrical sections includes the verification of existing conditions before the start of related installation work.

#### 1.9 COORDINATION DRAWINGS:

- A. Prepare coordination drawings for the mechanical and plumbing work of Divisions 21, 22, 23, 26 and 28, in compliance with the requirements of Division 1 and the additional requirements of this Section..
- B. Coordination drawings shall indicate how work provided under different sections will be coordinated and installed in the available spaces. Coordination drawings shall also indicate the sequence of installation work of the various sections.

Coordination Drawings shall include work by sub-contractors and fabricators when off-site fabrication of work and production materials will interface with other trades.

- C. Each of the following sub-contractors shall indicate their work on architectural backgrounds available on Revit AutoCAD electronic files. Coordination drawings shall show the work of all major trades without the excluding the work of any particular trade. Coordination drawings shall include, but not be limited to. The work of the following trades:
  - 1. Sheetmetal
  - 2. Plumbing
  - 3. Steamfitter/Pipefitter
  - 4. Sprinkler/Fire Protection
  - 5. Electrical
  - 6. Telecommunications
- D. Contractor shall produce 3/8-inch scale or larger, reproducible drawings produced on AutoCAD or Revit that shall include the following general information:
  - 1. Outline of all structural grid reference lines.
  - 2. Elevation reference lines.
  - 3. Structural steel beam sizes and column layout.
  - 4. Partition and door layout.
  - 5. Room or space number.
  - 6. Fire rating of partition penetrations.
  - 7. Acoustical ceiling layout.
  - 8. Firewalls and smoke partitions.
- E. Copies of the coordination drawings shall be distributed to each subcontractor and subsequently each trade shall indicate its work and show elevations, sizes, pipe and duct insulation, junction boxes, and fixture sizes.

- F. Conflicts shall be identified for immediate attention and resolution. Upon resolution of all conflicts, the coordinated drawings shall be signed by all trades and submitted to the Architect in accordance with Section 01 30 00, for review and confirmation of compliance with the Contract Documents.
- G. Additional work required to accommodate a trade that failed to coordinate his work in a timely manner will be paid for by the subcontractor who failed to coordinate his work.
- H. Where conflicts occur regarding the location of materials of various trades, the Contractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initiated and dated by the specialty trade. The Contractor shall then final date and sign each drawing.
- I. A sub-contractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
- J. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Architect and have been reviewed.
- K. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other work.
- L. Coordination Drawings shall include the following work:
  - 1. Structural elements.
  - 2. Partition/room layout.
  - 3. Ceiling grid.
  - 4. Lighting fixtures.
  - 5. Smoke and heat detectors.
  - 6. Access panels.
  - 7. Sheetmetal, heating coils, boxes, grilles, diffusers, etc.
  - 8. All HVAC piping and valves.
  - 9. Fire and smoke dampers.

10. Fire rated sleeves.
11. Soil, waste and vent piping.
12. Water mains and branches.
13. Medical and specialty gas systems.
14. Fuel gas piping systems.
15. Roof drain piping.
16. Major electrical conduit runs, panelboards, feeder conduit and racks of branch conduit.
17. Miscellaneous metal support.
18. Fire standpipes and distribution piping.
19. Sprinkler piping and heads.
20. Heat tracing of piping.
21. Telecommunication and Building Control Conduits.
22. Seismic restraints.

1.10 WARRANTY:

- A. Upon completion of the Work and as a condition of its acceptance and final payment, deliver to the Architect two copies of a written Warranty agreeing to replace the work of Division 22, which fails due to defective materials or workmanship within one year after Date of Substantial Completion as that date is determined in accordance with the General Conditions.
- B. Failure due to defective materials or workmanship is deemed to include, but is not to be limited to:
  1. Failures in operating component or components.
  2. Leakage from piping system.
  3. Code violations.
- C. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

- D. Replace material and equipment that require excessive service during warranty period as defined and as directed by Architect.
- E. Warranty shall include 24-hour service of complete system during warranty period at no cost to Owner. Choice of service organization shall be subject to Owner's approval.
- F. Include copy of warranty in the Operation and Maintenance Manuals.
- G. At end of warranty period, transfer manufacturer's equipment and material warranties still in force to Owner.
- H. This Article shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

#### 1.11 MANUALS AND INSTRUCTIONS:

- A. Comply with pertinent provisions of the appropriate Section in Division 1 regarding - Contract Closeout and Operations and Maintenance Manual Submissions.
- B. Operation and Maintenance Manuals: Bind Manuals in commercial quality, 8-1/2 x 11 inch three-ring binders with hardback washable, plastic cover, and provide identified dividers with tabs. Indicate appropriate model numbers in manufacturers' brochures and cross out non-applicable information. Review the Manuals with the Owner's maintenance personnel and add additional maintenance data sheets and information as directed by the Owner's Representatives. Copies of faxed pages are unacceptable.
  - 1. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items. Assemble literature in coordinated manuals with additional information describing combined operation of field-assembled units, including as-built wiring diagrams. Manual shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment.
  - 2. Provide directions for and sequences of operation for Plumbing systems of Division 22. Sequence shall list valves, switches, and other devices used to start, stop and control systems.
  - 3. Lubrication instructions detailing type of lubricant, amount, and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first-class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.

- C. Organization of Manuals: Divide manuals with identified tabs to match the mechanical and electrical specification sections numbers and titles. Separate product information within each section by the Article numbers and titles as listed in Part 2 of each specification section. Provide a clear see-through plastic holder on the edge of the binder with a typed card indicating the Project name, the Engineer's name, the Installer's name and the Volume number (e.g., Vol. No. 1 of 2).
- D. Manuals shall include the following materials and information for all specified materials and equipment:
  - 1. Table of contents.
  - 2. Emergency instructions with 24-hour phone number to contact a responsible individual for each Section of Work.
  - 3. Subcontractor's warranties.
  - 4. Name and telephone number of local representative and supplier.
  - 5. Manufacturers' maintenance procedures.
  - 6. Record drawings.
  - 7. Equipment warranties and guaranties.
  - 8. Sequence of Operations and Systems Descriptions.
  - 9. Additional requirements specified in other sections.
- E. Maintenance Information: Systems which require preventive maintenance to maintain efficient operation shall be furnished with complete necessary maintenance information. Required routine maintenance actions, as specified by the manufacturer, shall be stated clearly and incorporated on a readily accessible label on the equipment. Such label may be limited to identifying, by title or publication number, the operation and maintenance manual for that particular model and type of product.

#### 1.12 RECORD DOCUMENTS:

- A. Prepare record documents for the work of Division 22 as specified in Division 1 for Project Record Documents. The record drawings shall accurately indicate all valve locations and shall clearly show the assigned valve tag number. Record drawings shall include:

1. Piping and equipment location changes from the Contract Documents.
  2. Updated schedules to indicate the scheduled characteristics of the actual installed equipment.
  3. Valve locations and valve tag numbers.
  4. Equipment identification numbers coordinated with the Owner's Facility Management Program.
  5. Locations of seismic restraints.
- B. Record drawings include ductwork, sprinkler and fabrication drawings required for all other systems and coordination drawings prepared under the work of this contract. Provide reproducible drawings and electronic AutoCAD or Revit drawing files of both the contract drawings and additional fabrication/coordination drawings that indicate mechanical and electrical systems. All electronic files shall be fully bound and submitted on CD format.

#### 1.13 ELECTRONIC DRAWING FILES:

- A. Electronic drawing files of floor plans and schedules on AutoCAD or Revit or DXF format will be made available by the engineer for the contractor's use to prepare fabrication, coordination or record drawings. After the contractor requests the electronic files, a waiver will be provided for the contractor to sign and return to Weston & Sampson Engineers, Inc. A service charge of one hundred dollars (\$100.00) per disc will be charged to cover the cost of the Engineer's time and materials. After Weston & Sampson Engineers, Inc. receives the signed waiver the electronic drawing files will be forwarded to the Contractor.

#### 1.14 PHASING AND CONTINUITY OF SERVICES:

- A. All construction phasing shall comply with the Architect's phasing drawings and specifications and the requirements of the General Contractor and as required to maintain continuity of mechanical and electrical services for all systems that must be kept in operation.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES AND PENETRATIONS:

- A. Piping penetrations through fire rated construction shall comply with a listed fire rated assembly as detailed in the UL Fire Resistance Directory. Pipe sleeves through floors, exterior walls and fire-rated construction shall be galvanized



Schedule 40 steel pipe. Pipe sleeves through non-fire-rated partitions shall be 26-gauge galvanized steel.

1. Sleeves Through Foundation Walls: Provide galvanized schedule 40 steel with continuous weld slip on welding flange water stop. Provide waterproof resilient link caulking assembly by Link-Seal or Sure-Seal.
  2. In areas where pipe is exposed, install sleeves flush with the finish floor, except in mechanical rooms, and janitor's closets extend sleeves at least 4-inches above finish floor.
  3. Annular Space Requirements: Sleeves shall be sized to provide a total clearance of 1-inch around pipe including insulation cover. Annular space around fire-rated through penetrations assemblies shall be in compliance with the Listed Assembly.
  4. Packing between the pipe and sleeve in fire rated construction shall be a combination of listed insulation and fire-proof caulk. Coordinate with the work of the Division 7 Section for Penetration Firestopping.
  5. Core drilled holes in lieu of sleeves are acceptable except in mechanical rooms, janitor's closets or floors that can be flooded with water, which require sleeves installed above floors.
- B. Through Penetration Assemblies: The combination of materials shall have the same fire rating, in hours, as the wall or floor, as tested in accordance with the code referenced editions of ANSI/UL 1479 (ASTM E-814). The combination of materials shall be classified by UL for the fire rating required and shall be listed as a numbered system in the UL Fire Resistance Directory.
1. Caulking of pipe penetrations through floor slabs, smoke barriers and fire rated partitions shall be performed under the Division 7 Section for Firestopping.
- C. Waterproof Pipe Penetrations:
1. Modular mechanical penetrations seals shall be interlocking synthetic rubber links shaped to fill annular space continuously, with galvanized carbon steel bolts, nuts and pressure plates to expand rubber seal between pipe and sleeve. Sleeve seal shall be water-tight.
  2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire-rated) or preformed mineral fiber or silicone foam seal (fire-rated).

3. Provide waterproof 1-inch single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs on grade and existing walls below grade.
- D. Provide adjustable escutcheons on exposed piping that passes through finished floors, walls, and ceilings. Escutcheons shall be chromium-plated cast brass, sized to cover sleeve opening and to accommodate pipe and insulation.

## 2.2 PIPING IDENTIFICATION:

- A. Piping: Provide clip-on color-coded piping identification markers on plumbing piping systems specified in Division 22. Provide matching flow arrows to indicate direction of flow. Markers shall be equal to Seton Setmark. Pipe marking for outside diameters of 6-inches or greater may be springs or metal bands secured to the corners at each end of the semi-rigid plastic marker to hold each end of the marker firmly against the pipe.
1. Color coding and size of legend letters shall comply with the standards of ANSI A13.1.
  2. Provide markers with legend letters sized in compliance with the following schedules:

| Outside Diameter (Over Insulation) | Size of Letters: | Length of Color Code: |
|------------------------------------|------------------|-----------------------|
| 1-1/4-inch and smaller             | 1/2-inch         | 8-inches              |
| 1-1/2-inch to 2-inch               | 3/4-inch         | 8-inches              |
| 2-1/2-inch to 6-inches             | 1-1/4-inch       | 12-inches             |
| 8-inch                             | 2-1/2-inch       | 24-inches             |
| 10-inch and larger                 | 3-1/2-inch       | 32-inches             |

3. PLUMBING Systems: Provide color-coded identification markers in compliance with the following schedule with contrasting letters.

| Service:                 | Identification:              | Color Code:<br>(Background/Lettering) |
|--------------------------|------------------------------|---------------------------------------|
| Potable Cold Water       | Domestic Cold Water          | Green/Black                           |
| Potable Hot Water        | Domestic Hot Water           | Green/Black                           |
| Potable Hot Water Return | Domestic Hot Water<br>Return | Green/Black                           |
| Non-Potable Water        | Non-Potable Water            | Yellow/Black                          |
| Sanitary Waste           | Sanitary                     | Gray/White                            |
| Sanitary Vent            | Vent                         | Gray/White                            |

|                |                |              |
|----------------|----------------|--------------|
| Oil Waste      | Oil Waste      | Gray/White   |
| Oil Vent       | Oil Vent       | Gray/White   |
| Natural Gas    | Natural Gas    | Yellow/Black |
| Compressed Air | Compressed Air | Blue/White   |

4. Protection Guards: Provide Armstrong Armaflex 2000 white elastomeric insulation.

### 2.3 VALVE TAGS:

- A. Upon completion of piping installation work provide valve tags on all valves installed under the work of the PLUMBING Sections. Valve tags shall be at least 1-1/2-inch diameter brass or engraved plastic with 1/4-inch-high lettering for service designation over 1/2-inch-high consecutively numbered valve identification. Engraved valve tags shall be color coded as specified for piping identification. Coordinate valve tag numbers with the Owner's facility management program. Provide service designation prefix as scheduled.

|                             |         |
|-----------------------------|---------|
| 1. Systems:                 | Prefix: |
| A. Potable Cold Water       | CW      |
| B. Potable Hot Water        | HW      |
| C. Potable Hot Water Return | HWR     |
| D. Non-potable Cold Water   | NPCW    |
| E. Natural Gas              | NG      |
| F. Compressed Air           | CA      |
| G. Tepid Water              | TP      |

- B. Identify Non-Potable water outlets with permanently attached yellow color-coded marker or 4-inch-high triangle tag reading: Water Unsafe.
- C. Valve Schedules: For each piping system. On 8-1/2 by 11-inch bond paper. Tabulate valve number, piping system, system abbreviation as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

### 2.4 EQUIPMENT IDENTIFICATION:

- A. Stencil equipment such as pumps, water heaters, and tanks with the name of the equipment and equipment number. Stencils shall be at least 6-inches high and of a color to provide a contrast with the equipment finish.
- B. Equipment markings shall be prominently displayed on each normally visible side of the equipment. Equipment intended for installation in finished areas shall have markings located behind normally used access panels mounted so as to be readily

found. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings.

## 2.5 PRESSURE VESSELS:

- A. Pressure vessels including provided under Division 22 shall be ASME rated construction. All pressure vessels and air tanks shall be installed in accordance with ASME 2019 Boiler and pressure Vessel code section VIII and 522 CMR Board of Boiler Rules 7.0 Air Tanks.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Inspect site conditions before starting preparatory work and verify that actual conditions are known and acceptable before starting work. Be familiar with the work of other sections, separate contractors, and the Owner.
- B. Inspect areas where piping, conduit, ductwork, fixtures and equipment will be installed and verify adequate space is available for access, service and removal of equipment. Coordinate with the Work of other Sections.
- C. Notify the Architect immediately when the removal of existing ceilings, walls, or obstructions reveal conditions substantially different from the Contract Documents.

### 3.2 PREPARATION:

- A. Perform coordination with the work of other Sections and prepare composite coordination drawings as specified in this Section before starting installation work of Division 22.
- B. Verify points of connection to existing systems and confirm that required system shutdowns are acceptable with the Owner before proceeding with any related installation work.

### 3.3 CORE DRILLING:

- A. Do not core new concrete structure without written approval from the Engineer.
- B. Perform all core drilling required for the proper installation of the work of Division 22. Locate all required openings and prior to coring coordinate the opening with the other Trades and obtain approval from the Engineer.

- C. Thoroughly investigate the existing conditions in the vicinity of the required opening prior to cutting. Take care so as not to disturb the existing building systems. Damage to existing conditions incurred during core drilling shall be corrected to the Owners satisfaction with no additional expense to the Owner.

### 3.4 CUTTING AND PATCHING:

- A. Cutting and patching shall be performed under other Sections. Locate all other than cored openings required for the installation of the mechanical piping systems. Coordinate the opening with the work of the other trades so as not to interfere with the work of other Sections. Thoroughly investigate the existing conditions in the vicinity of the required openings as much as possible.
- B. Patching of the existing walls around openings shall be performed by the respective trade responsible for the finish material in which the opening is made.

### 3.5 SLEEVES AND PENETRATIONS:

- A. Coordination: Closely Coordinate electrical conduit, mechanical piping and ductwork penetrations through floor slabs and fire rated walls with the other Sections of Division 22 and the requirements of Division 7. Penetrations through fire rated construction shall consist of a complete rated assembly.
  - 1. UL -Listed through Penetration Components: In addition to the fire stop caulking provided under Division 7, the components of a fire-rated through penetration assembly include the piping size and material, annular space, and insulation type, density and thickness.
  - 2. Prepare a schedule of UL Through Penetration System numbers for submission and approval.
- B. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- C. Extend sleeves through Mechanical Room and other potentially wet floors at least 4-inches above finished floor level and provide pipe support sleeve.
- D. Install cast brass chrome plated escutcheons where piping passes through finished surfaces.
- E. Provide vertical flush wall cleanouts on the base of stacks just above the wainscot.

### 3.6 GENERAL INSTALLATION REQUIREMENTS:

- A. General: Coordinate with the work of other trades before starting installation. Install materials and equipment in accordance with the Manufacturers latest printed installation instructions and the product NRTL listing requirements.
1. Install piping straight, plumb and form right angles on parallel lines with building walls. Locate groups of pipes parallel to each other. Provide sufficient spacing for insulation and valve access.
  2. Install systems as high as possible to maximize ceiling heights.
  3. Pipe shall be free from scale and dirt. Protect open ended pipe ends to prevent debris from entering. All piping shall be reamed free of burrs.
  4. Locate valves for easy access and operation. Install valve stems above the horizontal.
  5. Piping connections to equipment shall be made with off-sets provided with isolation valves, unions or flanges arranged so that equipment can be serviced or removed without dismantling.
  6. Provide for expansion and contraction in all piping systems to prevent undue strains on piping or equipment. Provide double off-sets at risers to take up expansion.
  7. Install equipment with care to minimize damage to shop applied finishes. Replace or repair damaged components or finishes incurred during shipping and installation to the Owners satisfaction.
  8. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
  9. Cut pipe accurately and work into place without springing or forcing, and properly clearing windows, doors, and other openings.
  10. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
  11. Make changes in directions with fittings, make changes in main sizes with eccentric reducing fittings. Install water supply and return piping with straight side of eccentric fittings at top of the pipe.
  12. Run piping concealed above ceilings and within furred spaces. Take special care to locate stacks and risers within pipe chases as indicated on

the Architectural Drawings. Obtain approval from the Architect for piping locations which require furrings not indicated on the Contract Drawings.

13. Install equipment and components to minimize noise and vibration transmission to the structure. Provide vibration isolators and flexible connectors for all vibrating equipment.
14. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system.
15. Support piping independently at pumps, tanks and similar locations, so that weight of piping will not be supported by the equipment.
16. Pipe the drains from pump glands, drip pans, relief valves, air vents and similar locations, to spill through an air gap into a floor drain.
17. Securely bolt all equipment, isolators, hangers, and similar items in place.
18. Provide complete dielectric isolation between ferrous and non-ferrous metals.
19. Do not install plastic piping systems when the ambient temperature is below 60 degrees F.
20. Provide Armstrong Armaflex 2000 white insulation on pipe hangers, and to the sharp edges of mechanical systems when located below 6-foot 8-inches above the floor.
21. Insulating Clamps: Provide IPS Corp. Strap-Tite insulating clamps on uninsulated copper piping installed through metal stud perforations.
22. Install escutcheons for piping penetrations of walls, ceilings, and finished floors. Install escutcheons with ID to closely fit around pipe, tube and insulated pipe and with OD that completely covers opening.
23. Install floor plates for piping penetrations of equipment room floors. Install floor plates with ID to closely fit around pipe, tube and insulation of piping and with OD that completely covers opening.

B. Equipment Access for Maintenance and Removal:

1. Install piping, equipment and accessories to permit access for maintenance as specified by the equipment manufacturer. Provide adequate clearance to disconnect equipment for removal. Locate valves and unions so additional piping removal is not necessary to remove equipment. Coordinate piping

and equipment locations with all trades to ensure adequate clearance is maintained for equipment maintenance and removal.

2. Relocate items as necessary to provide access for maintenance and removal without additional cost to the Owner.

### 3.7 IDENTIFICATION OF PIPING AND EQUIPMENT:

- A. Piping: Install pipe and conduit identification markers in compliance with ANSI A13.1 on each side of wall penetrations, at each valve, at tee fittings, behind access panels and base of risers. Spacing of markers shall not exceed 20 feet and shall include at least one marker in each room. Ensure that markers are visible from 4-foot 6-inches to 6 feet above the finish floor.
  1. Install markers on painted piping only after painting is complete and has been accepted by the Architect. Install marker adjacent to access panels where piping is concealed.
- B. Equipment: Stencil equipment such as pumps, water heaters, and tanks with the name of the equipment and equipment number. Coordinate equipment numbers with the Owner's maintenance personnel. Stencils shall be at least 6-inches high and of a color to provide a contrast with the equipment finish.
- C. Equipment markings shall be prominently displayed on each normally visible side of equipment. Equipment intended for installation in finished area shall have markings located behind normally used access panels mounted so as to be readily found. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings.

### 3.8 SCAFFOLDING, HOISTING, RIGGING AND STAGING:

- A. Provide scaffolding, hoisting, rigging, conveyance apparatus and staging in as required to perform the work specified in the Plumbing sections of Division 22.

### 3.9 RECORD DOCUMENTS:

- A. Project Progress and Record Drawings: Comply with the appropriate Section of Division 1 governing Project Record Documents and the additional requirements of this Section.
  1. Maintain a daily record of the project construction progress by coloring the work completed on the white prints furnished by the Owner at the commencement of the work.
  2. Modify the equipment schedules to reflect data consistent with that of the installed equipment. Clearly show all changes to the work as a result of



addenda, change orders, clarifications, instructions issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new work and their relationship to existing work. Provide dimensions from permanent site improvements or column centerlines.

3. The marked up and colored in prints will be used as a guide for determining the progress of the work installed. They shall be inspected weekly and shall be corrected immediately if found inaccurate or incomplete. Requisitions for Payment will not be approved until the Drawings are accurate and up-to-date.
- B. At the completion of the work submit one set of the marked-up prints for review and acceptance. After acceptance, these marked up record prints shall be used to prepare the Owner's final Record Drawings.
- C. Maintain the established layering, color and pen thickness scheme on modified electronic drawing files.
- D. Make all modifications on the AutoCAD or Revit Drawing files indicated on the approved marked up set of Record Drawings. Remove all superseded data to show the completed installation.
- E. The final approved AutoCAD or Revit Record Drawing files shall become the property of the Owner.
- F. Deliver the completed Record Documents properly titled and dated to the Architect. These Record Documents shall become the property of the Owner.

### 3.10 SYSTEM START-UPS AND INSTRUCTIONS:

- A. Start-Ups: Perform system and equipment start-ups in accordance with the manufacturers' printed start-up instructions in the presence of the manufacturers' representatives.

### 3.11 CONSTRUCTION CERTIFICATIONS AND AFFIDAVITS:

- A. Engineer's Responsibility: During construction the Engineer is responsible for the following services as defined by the Massachusetts State Building Code, 780 CMR Section 107.2:
  1. Review, for conformance to the design concept, shop drawings, samples and other submittals, which are submitted by the contractor in accordance with the requirements of the construction documents.

2. Review and approval of the quality control procedures for all code-required controlled materials.
  3. Be present at intervals appropriate to the stage of construction to become, generally familiar with the progress and quality of the work and to determine, in general, if the work is being performed in a manner consistent with the construction documents.
- B. Contractor's Responsibility: The Contractor is solely responsible for the completion of the work on schedule and in compliance with the Contract Documents and the applicable codes; and for scheduling sufficient time for all required testing and submissions and approvals.
1. Construction Affidavits: If upon the completion of the construction, the Building Official requires Affidavits from a Professional Engineer stating that the Contractor's work is in accordance with the approved construction documents and with applicable local, state and federal statutes and regulations as required by 780 CMR 107.3, the Contractor shall retain the services of a qualified Registered Professional Engineer to be on site during construction.
  2. Submission Schedule: Allow sufficient time for the initial submission; Architect/Engineer review; resubmission; and final review and approval of all documents required for acceptance of the request for a Certificate of Occupancy in accordance with 780 CMR 111.
  3. Testing Schedule: Allow sufficient time for the initial testing, adjustments, and final functional operational testing of all fire protection systems as outlined in the Fire Protection Narrative.
- C. Construction Certifications: After the Contractor submits signed Certifications of Compliance as required by the Massachusetts State Building Code, 780 CMR, Section 107.3, and complies with the requirements of 780 CMR 111, the responsible engineers will provide written certifications to confirm that to the best of the engineer's knowledge, information, and belief, the finished work is in compliance with the approved drawings issued for permit.
1. Prior to submission of the final signed Certifications of Compliance, the Contractor shall submit written responses to all punch list items submitted by the design team.
  2. The Engineer will not submit certifications until all required certifications of testing, compliance and completion of punch list items have been submitted to the Engineer.

### 3.12 ADDITIONAL REQUIREMENTS FOR THE COMPLETION OF THE PROJECT

## Ninth Edition 780 CMR 107.6 Construction Control Document

### *Construction Contractor Services Certification Pursuant to Section 107.6.3*

**Name of Contractor:** \_\_\_\_\_

If a Corporation, name of responsible Corporate Officer:

\_\_\_\_\_

If a DBA or Partnership, name of individual:

\_\_\_\_\_

I hereby certify that, to the best of my knowledge and belief, construction performed under permit number \_\_\_\_\_ issued on \_\_\_\_\_ has been completed in substantial accord with the approved construction documents, with all pertinent deviations specifically noted per Section 107.6.3 of the Massachusetts State Building Code (780 CMR), 9<sup>th</sup> Edition Base Volume.

**Name of Project:** \_\_\_\_\_

**Address of Project:** \_\_\_\_\_

**List of Pertinent Deviations:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Print Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Notarized by:** \_\_\_\_\_

**Standard Notary Statement:**

This document shall be submitted to the *Responsible Registered Design Professional* (RDP) and, when requested, to the Building Official in accordance with 780 CMR section 107.6.3 (9<sup>th</sup> edition) at the completion of all construction projects performed pursuant to 780 CMR Section 107.6 *Control Construction*.

# **REQUIREMENTS FOR THE ISSUE OF PLUMBING FINAL CONSTRUCTION AFFIDAVIT Cover Sheet**

All required documents shall be provided as a single submission attached to this sign off sheet.

|                                                                                                                                                                                              |                        |      |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|-----------|
| <b>The Plumbing Contractor shall provide notarized certificates of completion for the work done by the Contractor and each of the sub subs including but not limited to (form attached):</b> |                        |      |           |
|                                                                                                                                                                                              | Attached<br>(Y, N, NA) | Date | Signature |
| Signed off and stamped Post Construction Affidavit - Plumbing                                                                                                                                |                        |      |           |
| Automatic Temperature Control (BMS/SKADA) as needed                                                                                                                                          |                        |      |           |
| Eyewash/Shower(s)                                                                                                                                                                            |                        |      |           |
| Air Compressor(s)                                                                                                                                                                            |                        |      |           |
|                                                                                                                                                                                              |                        |      |           |
| Other:                                                                                                                                                                                       |                        |      |           |

|                                                        |                        |      |           |
|--------------------------------------------------------|------------------------|------|-----------|
| <b>Minimum documentation required</b>                  |                        |      |           |
|                                                        | Attached<br>(Y, N, NA) | Date | Signature |
| Approved pipe pressure test reports                    |                        |      |           |
| Approved potable water chlorination report             |                        |      |           |
| Approved emergency eye wash/shower test report         |                        |      |           |
| Approved As-Builts signed by Contractor                |                        |      |           |
|                                                        |                        |      |           |
| Copy of Plumbing Inspector's Certificate of Inspection |                        |      |           |
| Up to date monetized punch list                        |                        |      |           |
| O&M manuals Check off Sheet (form attached)            |                        |      |           |
| Other:                                                 |                        |      |           |

# OPERATIONS & MAINTENANCE MANUALS CHECK LIST & SIGN OFF COVER SHEET

|                                                                                      | INITIAL |
|--------------------------------------------------------------------------------------|---------|
| All O&M's shall be assembled with dividers with tabs.                                |         |
| Dividers for equipment shall be sorted by Section Number.                            |         |
| O&M manuals shall include the following:                                             |         |
| Table of Contents                                                                    |         |
| Warranties (including subcontractors)                                                |         |
| Contractor contact list, normal & emergency                                          |         |
| Vendor contact list                                                                  |         |
| Valve tag chart                                                                      |         |
| Air Tank inspection (if OWNER's insurance or state required)                         |         |
| Hot water inspection (if OWNER's insurance or state required)                        |         |
| All equipment in project                                                             |         |
| Record drawings including the following:                                             |         |
| All piping, and equipment location changes from the contract documents               |         |
| Updated schedules of actual equipment installed if different from contract documents |         |
| Valve locations and valve tag numbers                                                |         |
| Equipment identification numbers                                                     |         |
| Seismic restraint locations                                                          |         |
|                                                                                      |         |

END OF SECTION

## SECTION 22 05 13

### COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 RELATED DOCUMENTS:

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

##### 1.3 SUMMARY:

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

##### 1.4 COORDINATION:

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

## PART 2 - PRODUCTS

### 2.1 GENERAL MOTOR REQUIREMENTS:

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

### 2.2 MOTOR CHARACTERISTICS:

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

### 2.3 POLYPHASE MOTORS:

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.



- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS:

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 2.5 SINGLE-PHASE MOTORS:

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

## SECTION 22 05 19

### METERS AND GAGES FOR PLUMBING PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:
  - Section 22 11 16 – DOMESTIC WATER PIPING
  - Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES
  - Section 22 15 13 – GENERAL-SERVICE COMPRESSED-AIR PIPING

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.
  - 6. Test plugs.
  - 7. Test-plug kits.

1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS:

- A. Product Certificates: For each type of meter and gage.

1.6 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS:

- A. Standard: ASME B40.200.
- B. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
- C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- G. Window: Plain glass or plastic.
- H. Ring: Stainless steel.
- I. Element: Bimetal coil.
- J. Pointer: Dark-colored metal.
- K. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS:

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.

3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 THERMOWELLS:

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES:

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.

8. Window: Glass or plastic.
9. Ring: Brass or Stainless steel.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

## 2.5 GAGE ATTACHMENTS:

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## 2.6 TEST PLUGS:

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: EPDM self-sealing rubber.

## 2.7 TEST-PLUG KITS:

- A. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. 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.
- J. Install pressure gages 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.

### 3.2 CONNECTIONS:

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING:

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE:

- A. Thermometers at inlet and outlet of each domestic water heater, heat exchanger and storage tank shall be one of the following:
  - 1. Liquid-filled Sealed, bimetallic-actuated type.
  - 2. Metal case, industrial-style, liquid-in-glass type.
  - 3. Test plug with EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE:

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE:

- A. Pressure gages shall be the following:
  - 1. Liquid-filled Sealed, direct-mounted, metal case.
  - 2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE:

- A. Scale Range for Water Service Piping: 0 to 160 psi.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION



## SECTION 22 05 23

### VALVES FOR PLUMBING PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 0 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 RELATED DOCUMENTS

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

##### 1.3 SUMMARY

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.
  - 3. Steel ball valves.
  - 4. Iron ball valves.
  - 5. Bronze lift check valves.
  - 6. Bronze swing check valves.
  - 7. Bronze gate valves.
  - 8. Iron gate valves.

##### 1.4 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and soldered ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Set check valves in either closed or open position.
  - 5. Set gate valves closed to prevent rattling.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 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 solder-joint connections.
  6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Actuator Types:
1. Gear Actuator: For quarter-turn ball valves NPS 4 and larger.
  2. Handlever: For quarter-turn ball valves smaller than NPS 4.
- I. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
  2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  3. Memory stops that are fully adjustable after insulation is applied.
  4. RS Gate Valves in Insulated Piping: With 2-inch stem extensions.
- J. Valve Sizes: Same as upstream piping unless otherwise indicated.
- K. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRASS BALL 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. American Valve, Inc.
  2. Apollo Valves; a part of Aalberts Integrated Piping Systems.
  3. Crane, a Crane Co. brand.
  4. Jenkins Valves; a Crane Co. brand.
  5. Jomar Valve
  6. KITZ Corporation.

7. Marwin Valve; Richards Industries.
8. Milwaukee Valve Company.
9. WATTS.

B. Brass Ball Valves, Two-Piece, Threaded or Soldered Ends:

1. Description:
  - a. Standard: MSS SP-110 or MSS SP-145.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Forged brass.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

## 2.3 BRONZE BALL 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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
2. Center Line; a Crane Co. brand.
3. Jenkins Valves; a Crane Co. brand.
4. Milwaukee Valve Company.
5. NIBCO INC.
6. WATTS.
7. Zurn Industries, LLC.

B. Bronze Ball Valves, Two-Piece, Threaded or Soldered Ends:

1. Description:
  - a. Standard: MSS SP-110 or MSS-145.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Bronze or brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

## 2.4 STEEL BALL 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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
  - 2. FNW; Ferguson Enterprises, Inc.
  - 3. Milwaukee Valve Company.
  - 4. NIBCO INC.
  - 5. Stockham; a Crane Co. brand.
  - 6. WATTS.
- B. Steel Ball Valves with Full Port, Class 150:
  - 1. Description:
    - a. Standard: MSS SP-72.
    - b. CWP Rating: 285 psig.
    - c. Body Design: Split body.
    - d. Body Material: Carbon steel, ASTM A216, Type WCB.
    - e. Ends: Flanged or threaded.
    - f. Seats: PTFE.
    - g. Stem: Stainless steel.
    - h. Ball: Stainless steel, vented.
    - i. Port: Full.

## 2.5 IRON BALL 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. American Valve, Inc.
  - 2. Apollo Valves; a part of Aalberts Integrated Piping Systems.
  - 3. Sure Flow Equipment Inc.
  - 4. WATTS.
- B. Iron Ball Valves, Class 125:
  - 1. Description:
    - a. Standard: MSS SP-72.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Split body.
    - d. Body Material: ASTM A126, gray iron.

- e. Ends: Flanged or threaded.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

## 2.6 BRONZE 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:

- a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
- b. Crane Valves; a Crane Co. brand.
- c. Jenkins Valves; a Crane Co. brand.
- d. NIBCO INC.
- e. Stockham; a Crane Co. brand.
- f. Victaulic Company.

- B. Bronze Lift Check Valves, Class 125:

1. Description:

- a. Standard: MSS SP-80.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B61 or ASTM B62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

- C. Bronze Swing Check Valves, Class 125:

1. Description:

- a. Standard: MSS SP-80.
- b.** CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

## 2.7 IRON SWING 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. Anvil International.
2. APCO DeZurik Valve Co.
3. Apollo Valves; a part of Aalberts Integrated Piping Systems.
4. Crane Valves; a Crane Co. brand.
5. FNW; Ferguson Enterprises, Inc.
6. Jenkins Valves; a Crane Co. brand.
7. KITZ Corporation.
8. Powell Valves.
9. Tyco by Johnson Controls Company.
10. Victaulic Company.

B. Iron Swing Check Valves with Metal Seats, Class 125:

1. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Clear or full waterway.
  - d. Body Material: ASTM A126, gray iron with bolted bonnet.
  - e. Ends: Flanged or threaded. See valve schedule articles.
  - f. Trim: Bronze.
  - g. Gasket: Asbestos free.

## 2.8 BRONZE GATE 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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
2. Crane Valves; a Crane Co. brand.
3. Jenkins Valves; a Crane Co. brand.
4. KITZ Corporation.
5. Milwaukee Valve Company.
6. NIBCO INC.
7. Powell Valves.
8. Stockham; a Crane Co. brand.
9. WATTS.

B. Bronze Gate Valves, NRS, Class 125:

1. Description:
  - a. Standard: MSS SP-80.
  - b. CWP Rating: 200 psig.
  - c. Body Material: Bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.

- e. Stem: Bronze, rising.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Bronze Gate Valves, Class 150:

1. Description:

- a. Standard: MSS SP-80.
- b. CWP Rating: 300 psig.
- c. Body Material: Bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze, rising.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

## 2.9 IRON GATE 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. Crane Valves; a Crane Co. brand.
- 2. FNW; Ferguson Enterprises, Inc.
- 3. KITZ Corporation.
- 4. Powell Valves.
- 5. Zurn Industries, LLC.

B. Iron Gate Valves, OS&Y, Class 125:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: Gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Check Valves: Install check valves for proper direction of flow.
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Lift Check Valves: With stem upright and plumb.
- F. Install valve tags. Comply with requirements in Section 22 00 50 "Basic Plumbing Requirements" for valve tags and schedules.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 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 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: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  - 7. For Grooved-End Copper Tubing: Grooved.
- C. If valve applications are not indicated, use the following:
  - 1. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.
    - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- D. Use gate valves for shutoff service only.
- E. For Grooved-End Copper Tubing: Gate Valve ends may be grooved.

### 3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Bronze or brass ball valves, two-piece with full port and bronze or brass trim.
  - 3. Horizontal and Vertical Applications: Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.
  - 4. Bronze gate valves, RS, Class 150 with soldered or threaded ends.
- B. Pipe NPS 2-1/2 and Larger:

1. Steel Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, stainless-steel disc.
4. Iron swing check valves with metal seats, Class 175, with flanged end connections.

### 3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

1. Bronze or brass ball valves, two-piece with full port and bronze or brass trim. Provide with threaded or solder-joint ends.
2. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
3. Bronze gate valves, RS, Class 125 with soldered or threaded ends.

#### B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron ball valves, Class 150.
4. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze or stainless-steel disc.
5. Ductile-Iron, Grooved-End Butterfly Valves: 175 CWP.
6. Iron swing check valves with metal seats, Class 125, with flanged end connections.
7. Iron, grooved-end swing check valves, 300 CWP.
8. Iron gate valves, OS&Y, Class 125 with flanged ends.

END OF SECTION

## SECTION 22 05 29

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections: See Section References for each Division in Section 22 00 50.

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Pipe positioning systems.
  - 8. Equipment supports.

##### 1.4 DEFINITIONS:

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.5 PERFORMANCE REQUIREMENTS:

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test 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.

#### 1.6 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Pipe stands.
  - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

#### 1.7 INFORMATIONAL SUBMITTALS:

- A. Welding certificates.

#### 1.8 QUALITY ASSURANCE:

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS:

#### A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

#### B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

#### C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

### 2.2 TRAPEZE PIPE HANGERS:

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.3 METAL FRAMING SYSTEMS:

#### A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturred lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Metallic Coating: Hot-dipped galvanized.

#### 2.4 THERMAL-HANGER SHIELD INSERTS:

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

#### 2.5 FASTENER SYSTEMS:

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

#### 2.6 PIPE STANDS:

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece stainless steel unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.7 PIPE POSITIONING SYSTEMS:

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.8 ANCHORS AND ALIGNMENT GUIDES:

- A. Pipe Anchors: Anchors shall provide support designed to control movement and stop pipe from shifting in three dimensions.
1. Anchors shall be copper coated steel or stainless-steel shape and plates. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME/ANSI B31.3.
  2. Fixed anchor points shall be measured and installed to accommodate forces of expansion in the pipe and probable additional loads.
- B. Alignment Spider Guides: Guides shall ensure positive pipe alignment by restricting pipe movement in all directions except along the axis of the pipe.
1. Guides shall be copper coated steel or stainless steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe. Guide body shall be split at 45 degrees to permit pipe nesting. Guides shall be selected to accommodate pipe insulation.



2. Guide maximum spacing shall be as required by ASME/ANSI B31.3. Guides shall be designed to restrict a lateral force equal to 250 lb/inch of nominal pipe size.

## 2.9 EQUIPMENT SUPPORTS:

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.10 MISCELLANEOUS MATERIALS:

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION:

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

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 according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 – ROOF ACCESSORIES for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. 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.
- O. 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. 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 shall span an arc of 180 degrees.
  - a. 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: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS:

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS:

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING:

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.5 PAINTING:

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE:

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use carbon-steel pipe hangers and supports and metal framing systems 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 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- 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. 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.
  17. 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.
  18. 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 not necessary.
- 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- 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.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION



## SECTION 22 05 48

### VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections: See Section References for each Division in Section 22 00 50.

##### 1.3 SUMMARY:

- A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.
17. Adhesive anchor bolts.

#### 1.4 DEFINITIONS:

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

#### 1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
  3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
  4. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic 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 seismic events. Indicate association with vibration isolation devices.
    - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    - d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS:

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE:

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS:

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: D.

2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
  - a. Component Importance Factor: 1.5.
  - b. Component Response Modification Factor: 2.5.
  - c. Component Amplification Factor: 1.0.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.25
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.117.
5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

## 2.2 ELASTOMERIC ISOLATION PADS:

- A. Elastomeric Isolation Pads: .
  1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  2. Size: Factory or field cut to match requirements of supported equipment.
  3. Pad Material: Oil and water resistant with elastomeric properties.
  4. Surface Pattern: Smooth pattern.
  5. Infused nonwoven cotton or synthetic fibers.

6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric.

## 2.3 ELASTOMERIC ISOLATION MOUNTS:

### A. Double-Deflection, Elastomeric Isolation Mounts: .

1. 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.
2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS:

### A. Restrained Elastomeric Isolation Mounts: .

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - a. Housing: Cast-ductile iron or welded steel.
  - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.5 OPEN-SPRING ISOLATORS:

- A. Freestanding, Laterally Stable, Open-Spring Isolators: .
  1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

## 2.6 HOUSED-SPRING ISOLATORS:

- A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: .
  1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  2. Minimum Additional Travel: 50 percent of the required deflection at rated load.



3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

## 2.7 RESTRAINED-SPRING ISOLATORS:

- A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
  1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
    - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    - b. Top plate with threaded mounting holes.
    - c. Internal leveling bolt that acts as blocking during installation.
  2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.8 HOUSED-RESTRAINED-SPRING ISOLATORS:

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: .
  - 1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
  - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.9 PIPE-RISER RESILIENT SUPPORT:

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.
  - 1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  - 2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

## 2.10 RESILIENT PIPE GUIDES:

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.11 ELASTOMERIC HANGERS:

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
  1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.12 SPRING HANGERS:

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

#### 2.13 SNUBBERS:

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

#### 2.14 RESTRAINT CHANNEL BRACINGS:

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with 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.

#### 2.15 RESTRAINT CABLES:

- A. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

#### 2.16 SEISMIC-RESTRAINT ACCESSORIES:

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

#### 2.17 MECHANICAL ANCHOR BOLTS:

- A. Mechanical Anchor Bolts: 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 according to ASTM E 488.

#### 2.18 ADHESIVE ANCHOR BOLTS:

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION:

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS:

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

### 3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION:

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Equipment Restraints:
  - 1. Install seismic snubbers 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 seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- D. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.

- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. 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.
- I. 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.
- J. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: 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.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION:

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 22 11 16 – DOMESTIC WATER PIPING for piping flexible connections.

### 3.5 FIELD QUALITY CONTROL:

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### 3.6 ADJUSTING:

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION



## SECTION 22 07 19

### PLUMBING PIPING INSULATION (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:
  - Section 07 84 13 – PENETRATION FIRESTOPPING
  - Section 09 91 00 – PAINTING
  - Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

##### 1.3 SUMMARY:

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Domestic chilled-water piping for drinking fountains.
  - 5. Sanitary waste piping exposed to freezing conditions.
  - 6. Storm-water piping exposed to freezing conditions.
  - 7. Supplies and drains for handicap-accessible lavatories and sinks.

#### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated. 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 attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. 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.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Qualification Data: For qualified Installer.
- B. 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.
- C. Field quality-control reports.

#### 1.6 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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: 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 the Architect. Use materials indicated for the completed Work.
1. Piping Mockups:
    - a. One 10-foot 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.
  2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
  3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  4. Obtain Architect'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 Architect specifically approves such deviations in writing.
  6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  7. Demolish and remove mockups when directed.
- D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION:

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.9 SCHEDULING:

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS:

- 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 shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Block Insulation: ASTM C 552, Type I.
  - 2. Special-Shaped Insulation: ASTM C 552, Type III.
  - 3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS:

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

## 2.3 ADHESIVES:

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.

#### 2.4 MASTICS:

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 2. Service Temperature Range: 0 to 180 deg F.
  - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: 60 percent by volume and 66 percent by weight.
  - 4. Color: White.

## 2.5 LAGGING ADHESIVES:

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  - 3. Service Temperature Range: 0 to plus 180 deg F.
  - 4. Color: White.

## 2.6 SEALANTS:

- A. Joint Sealants for Cellular-Glass and Phenolic Products:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Permanently flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
  - 4. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: White.

## 2.7 FACTORY-APPLIED JACKETS:

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH:

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS:

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.10 FIELD-APPLIED JACKETS:

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: White.
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
  - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-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. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

- a. Sheet and roll stock ready for shop or field sizing.
- b. Material, finish, and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- e. Factory-Fabricated Fitting Covers:
  - 1) Same material, finish, and thickness as jacket.
  - 2) Preformed 2-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.

- D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES:

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Width: 3 inches.
  2. Thickness: 11.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Width: 3 inches.

2. Thickness: 6.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
  2. Thickness: 6 mils.
  3. Adhesion: 64 ounces force/inch in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
  2. Thickness: 3.7 mils.
  3. Adhesion: 100 ounces force/inch in width.
  4. Elongation: 5 percent.
  5. Tensile Strength: 34 lbf/inch in width.

## 2.12 SECUREMENTS:

- A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015-inch-thick, 1/2 inch wide with wing seal or closed seal.
  2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

## 2.13 PROTECTIVE SHIELDING GUARDS:

- A. Protective Shielding Pipe Covers:
1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures:
1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## 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 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5-mils-thick and an epoxy finish 5-mils-thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS:

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. 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 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. 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.
- P. 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.

### 3.4 PENETRATIONS:

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.

- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 07 84 13 – PENETRATION FIRESTOPPING for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 – PENETRATION FIRESTOPPING.

### 3.5 GENERAL PIPE INSULATION INSTALLATION:

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a

- removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION:

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, 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.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION:

#### A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### B. Insulation Installation on Pipe Flanges:



1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 INSTALLATION OF MINERAL-FIBER INSULATION:

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied 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.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed 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.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.
5. that allow passage of air to surface being insulated.

### 3.9 FIELD-APPLIED JACKET INSTALLATION:

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.10 FINISHES:

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 90 00 – 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. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.11 FIELD QUALITY CONTROL:

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 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.

3.13 INDOOR PIPING INSULATION SCHEDULE:

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1-1/2 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- C. Domestic Chilled Water (Potable):
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- E. Sanitary Waste Piping Where Heat Tracing Is Installed:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
- F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

3.14 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE:

- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE:

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
- D. Piping, Exposed:
  - 1. PVC: 20 mils thick.
  - 2. Aluminum, Smooth: 0.020 inch thick.
  - 3. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.020 inch thick.

END OF SECTION

## SECTION 22 08 00

### COMMISSIONING OF PLUMBING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 and Division 22 Specification Sections, apply to this Section.
- B. Related Section:

Section 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

##### 1.3 SUMMARY:

- A. Section includes Cx process requirements for the following plumbing systems, assemblies, and equipment:
  - 1. Domestic water systems.
  - 2. Sanitary waste and vent systems.
  - 3. General-service compressed-air systems.
  - 4. Plumbing fixtures.

##### 1.4 DEFINITIONS:

- A. Cx: Commissioning, as defined in Section 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS.
- B. CxA: Commissioning Authority, as defined in Section 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS.

- C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Qualification Data: For plumbing testing technician.
- B. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.
- C. Construction Checklists: Material, installation, and performance test checklists for systems, assemblies, subsystems, equipment, and components to be part of the Cx process and according to requirements in Division 01.
  - 1. Domestic water systems, including the following:
    - a. Pumps, motors, accessories, and controls.
    - b. Gas fired Water Heaters.
    - c. Trap Primers.
    - d. Mixing valve.
    - e. Water meters.
  - 2. Sanitary waste and vent systems, including the following:
    - a. Sanitary oil/water interceptors.
  - 3. Plumbing fixtures, including the following:
    - a. Water closet flush valves.
    - b. Urinals flush valves.
    - c. Lavatory faucets.
    - d. Sink faucets.
    - e. Shower faucets.
    - f. Emergency stations operation and controls.
    - g. Drinking fountains.
  - 4. General-service compressed-air system, including the following:
    - a. Compressors, motors, accessories, and controls.
    - b. Compressed-air outlets and connections.
- D. Test equipment and instrumentation list, identifying 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.

#### 1.6 QUALITY ASSURANCE:

- A. Plumbing Testing Technician Qualifications: Technicians to perform plumbing 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 with knowledge of plumbing system, electrical concepts, and building operations.
  2. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. 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.
- C. 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.



- c. Plumbing system 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 CONSTRUCTION CHECKLISTS:

- A. Prepare detailed construction checklists for plumbing systems, assemblies, subsystems, equipment, and components.
  - 1. Domestic hot- and cold-water systems.
  - 2. Sanitary waste and vent systems.
  - 3. Plumbing fixtures.
  - 4. General-service compressed air systems.

### 3.2 CONSTRUCTION CHECKLIST REVIEW:

- A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.
- B. Return draft construction checklist review comments within 10 days of receipt.
- C. When review comments have been resolved, the CxA will provide final construction checklists, marked "Approved for Use, (date)."
- D. Use only construction checklists, marked "Approved for Use, (date)."

### 3.3 Cx TESTING PREPARATION:

- A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.
- B. Certify that plumbing systems instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, 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 Architect, 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 plumbing system, document the deficiency and report it to Architect. 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 PLUMBING:

- 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 operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response according to 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 tests requirements specified in Division 22 Sections specifying plumbing systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
  - 1. Construction checklist verification tests.
  - 2. Construction checklist verification test demonstrations.
  - 3. Cx tests.
  - 4. Cx test demonstrations.
- F. Supervision of Alarms in Plumbing Systems:

1. Prerequisites: Acceptance of results of construction checklists for plumbing systems specified:
2. Scope:
  - a. Supervised plumbing system alarms.
3. Purpose:
  - a. Verify reporting of supervised plumbing alarm at building management system.
4. Conditions of the Test:
  - a. Alarm monitoring systems operating in normal, automatic mode.
  - b. Activate supervised plumbing alarms, one at a time.
5. Acceptance Criteria:
  - a. Activation of supervised plumbing alarm generates alarm at building management system control panel.

G. Plumbing Meter Reporting:

1. Prerequisites: Acceptance of results of construction checklists for plumbing systems specified in the Sections listed below:
  - a. Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
2. Scope:
  - a. Supervised plumbing system water meters.
3. Purpose:
  - a. Verify accuracy of reporting of supervised plumbing system water meters at building management system.
4. Conditions of the Test:
  - a. Plumbing system water meter recording systems operating in normal, automatic mode.
  - b. Compare cumulative consumption data at plumbing system water meter recording systems with independent, calibrated flow-measuring instrumentation under the following conditions:
    - 1) Low Flow: 1 percent of maximum design flow rate for a period of four hours.
    - 2) High Flow: 80 percent of maximum design flow rate for a period of 20 minutes.

- c. Activate supervised plumbing alarms, one at a time.
- 5. Acceptance Criteria:
  - a. Cumulative flow reported for low-flow condition is within 5 percent flow recorded by calibrated flow-measuring instrumentation.
  - b. Cumulative flow reported for high-flow condition is within 1 percent flow recorded by calibrated flow-measuring instrumentation.

### 3.6 Cx TESTS FOR COMPRESSED AIR SYSTEMS:

#### A. Air Compressor Run Time:

- 1. Prerequisites:
  - a. Acceptance of results of construction checklists specified in the following:
    - 1) Section 22 15 19 – GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS.
- 2. Scope:
  - a. Air compressors in plumbing systems.
  - b. Associated compressed air piping, valves, and appurtenances.
  - c. Associated air pressure controllers.
- 3. Purpose: Evaluate air compressor run time and number of compressor starts.
- 4. Conditions of the Test:
  - a. Keep compressed air openings closed during test.
  - b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
  - c. Record number of air compressor motor starts during a 14-day period.
  - d. Record air compressor motor run time during the same 14-day period.
- 5. Acceptance Criteria:
  - a. Number of compressor motor starts during test period shall not exceed 20.
  - b. Compressor motor run time during test period shall not exceed 60 minutes.

END OF SECTION

SECTION 22 11 16  
DOMESTIC WATER PIPING  
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 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. Related Sections:

Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

Section 22 11 23 – DOMESTIC WATER PUMPS

Division 31 – EARTHWORK

1.3 SUMMARY:

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. Ductile-iron pipe and fittings.
  - 3. Piping joining materials.

4. Encasement for piping.
5. Transition fittings.
6. Dielectric fittings.

#### 1.4 ACTION SUBMITTALS:

- A. Product Data: For transition fittings and dielectric fittings.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

#### 1.6 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 according to requirements indicated:
  1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
  2. Do not interrupt water service without Construction Manager's written permission.

### PART 2 - PRODUCTS

#### 2.1 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.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF Standard 372 for low lead.

#### 2.2 COPPER TUBE AND FITTINGS:

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- F. Copper-Tube, Extruded-Tee Connections:
  - 1. Description: Tee formed in copper tube according to ASTM F 2014.

## 2.3 DUCTILE-IRON PIPE AND FITTINGS:

- A. Mechanical-Joint, Ductile-Iron Pipe:
  - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
  - 1. AWWA C110/A21.10, ductile or gray iron.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
  - 3. Gaskets: AWWA C111/A21.11, rubber.
- C. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

## 2.4 ENCASEMENT FOR PIPING:

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.

## 2.5 TRANSITION FITTINGS:

- 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.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
- D. Plastic-to-Metal Transition Fittings:
1. Description:
    - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- E. Plastic-to-Metal Transition Unions:
1. Description:
    - a. CPVC or PVC four-part union.
    - b. Brass or stainless-steel threaded end.
    - c. Solvent-cement-joint or threaded plastic end.
    - d. Rubber O-ring.
    - e. Union nut.

## 2.6 DIELECTRIC FITTINGS:

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Standard: ASSE 1079.
  2. Pressure Rating: 150 psig.
  3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. Standard: ASSE 1079.
  2. Factory-fabricated, bolted, companion-flange assembly.
  3. Pressure Rating: 150 psig.
  4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
  2. Pressure Rating: 150 psig.



3. Gasket: Neoprene or phenolic.
  4. Bolt Sleeves: Phenolic or polyethylene.
  5. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
  2. Electroplated steel nipple complying with ASTM F 1545.
  3. Pressure Rating and Temperature: 300 psig at 225 deg F.
  4. End Connections: Male threaded or grooved.
  5. Lining: Inert and noncorrosive, propylene.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK:

- A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

#### 3.2 PIPING INSTALLATION:

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING and with requirements for drain valves and strainers in Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 – DOMESTIC WATER PUMPS
- U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 00 50.
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 00 50.

- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 00 50

### 3.3 JOINT CONSTRUCTION:

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. 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.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 TRANSITION FITTING INSTALLATION:

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 DIELECTRIC FITTING INSTALLATION:

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.6 HANGER AND SUPPORT INSTALLATION:

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.

- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

### 3.7 CONNECTIONS:

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.8 IDENTIFICATION:

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 00 50.
- B. Label pressure piping with system operating pressure.

### 3.9 FIELD QUALITY CONTROL:

#### A. Perform the following 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 roughing in 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. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

#### B. Domestic water piping will be considered defective if it does not pass tests and inspections.

#### C. Prepare test and inspection reports.

### 3.10 ADJUSTING:

#### A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 CLEANING:

#### A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.

- B. Clean non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 PIPING SCHEDULE:

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. 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 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
  - 2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
- F. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.



- G. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
- H. Aboveground domestic water piping, NPS 2-1/2 and larger, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

### 3.13 VALVE SCHEDULE:

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

## SECTION 22 11 19

### DOMESTIC WATER PIPING SPECIALTIES (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 06 10 00 – ROUGH CARPENTRY

Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

Section 22 05 23 – VALVES FOR PLUMBING PIPING

Section 22 11 16 – DOMESTIC WATER PIPING

Section 22 45 00 – EMERGENCY PLUMBING FIXTURES

Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

##### 1.3 SUMMARY:

- A. Section Includes:

- 1. Vacuum breakers.
- 2. Backflow preventers.

3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Air vents.
13. Trap-seal primer valves.
14. Trap-seal primer systems.
15. Specialty valves.
16. Flexible connectors.
17. Expansion tanks.

#### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
  1. Include diagrams for power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Field quality-control reports.

#### 1.6 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. Potable-water piping and components shall comply with NSF 61 Annex G.

#### 2.2 PERFORMANCE REQUIREMENTS:

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

## 2.3 VACUUM BREAKERS:

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Standard: ASSE 1001.
  - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: Threaded.
  - 5. Finish: Rough bronze or Chrome plated.
- B. Hose-Connection Vacuum Breakers:
  - 1. Standard: ASSE 1011.
  - 2. Body: Bronze, nonremovable, with manual drain.
  - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 4. Finish: Chrome or nickel plated.
- C. Laboratory-Faucet Vacuum Breakers:
  - 1. Standard: ASSE 1035.
  - 2. Size: NPS 1/4 or NPS 3/8 matching faucet size.
  - 3. Body: Bronze.
  - 4. End Connections: Threaded.
  - 5. Finish: Chrome plated.

## 2.4 BACKFLOW PREVENTERS:

- A. Intermediate Atmospheric-Vent Backflow Preventers:
  - 1. Standard: ASSE 1012.
  - 2. Operation: Continuous-pressure applications.
  - 3. Size: NPS 3/4.
  - 4. Body: Bronze.
  - 5. End Connections: Union, solder joint.
  - 6. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:
  - 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 part of Aalberts Integrated Piping Systems.
    - b. WATTS.
    - c. Zurn Industries, LLC.
  - 2. Standard: ASSE 1013.
  - 3. Operation: Continuous-pressure applications.
  - 4. Pressure Loss: 12 psig maximum, through middle third of flow range.
  - 5. Body: Bronze for NPS 2 and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 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.

C. Double-Check, Backflow-Prevention Assemblies:

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

D. Hose-Connection Backflow Preventers:

1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 1/2 or NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

E. Backflow-Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

## 2.5 WATER PRESSURE-REDUCING VALVES:

A. Water Regulators:

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 part of Aalberts Integrated Piping Systems.
  - b. Cash Acme, A Division of Reliance Worldwide Corporation.

- c. WATTS.
  - d. Zurn Industries, LLC.
2. Standard: ASSE 1003.
  3. Pressure Rating: Initial working pressure of 150 psig.
  4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
  5. Valves for Booster Heater Water Supply: Include integral bypass.
  6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

## 2.6 BALANCING VALVES:

- A. Copper-Alloy Calibrated Balancing Valves:
  1. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
  2. Body: Brass or bronze.
  3. Size: Same as connected piping, but not larger than NPS 2.
  4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Cast-Iron Calibrated Balancing Valves:
  1. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
  2. Size: Same as connected piping, but not smaller than NPS 2-1/2.
- C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- D. Memory-Stop Balancing Valves:
  1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  2. Pressure Rating: 400-psig minimum CWP.
  3. Size: NPS 2 or smaller.
  4. Body: Copper alloy.
  5. Port: Standard or full port.
  6. Ball: Chrome-plated brass.
  7. Seats and Seals: Replaceable.
  8. End Connections: Solder joint or threaded.
  9. Handle: Vinyl-covered steel with memory-setting device.

## 2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES:

- A. Water-Temperature Limiting Devices:
  1. Standard: ASSE 1017.
  2. Pressure Rating: 125 psig.
  3. Type: Thermostatically controlled, water mixing valve.
  4. Material: Bronze body with corrosion-resistant interior components.

5. Connections: Threaded union inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Rough bronze.
8. Piping Finish: Copper.
9. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

C. Individual-Fixture, Water Tempering Valves:

1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze body with corrosion-resistant interior components.
4. Temperature Control: Adjustable.
5. Inlets and Outlet: Threaded.
6. Finish: Rough or chrome-plated bronze.

## 2.8 STRAINERS FOR DOMESTIC WATER PIPING:

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.125 inch.
6. Drain: Factory-installed, hose-end drain valve.

## 2.9 OUTLET BOXES:

### A. Clothes Washer Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

### B. Icemaker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.10 HOSE BIBBS:

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, chrome or nickel plated.
9. Finish for Service Areas: Rough bronze or Chrome plated.
10. Finish for Finished Rooms: Chrome plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.



## 2.11 WALL HYDRANTS:

### A. Non-freeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

## 2.12 DRAIN VALVES:

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.13 WATER-HAMMER ARRESTERS:

### A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.14 AIR VENTS:

### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER DEVICE:

A. Supply-Type, Trap-Seal Primer Device:

1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
2. Size: NPS 1-1/4 minimum.
3. Material: Chrome-plated, cast brass.

2.16 TRAP-SEAL PRIMER SYSTEMS:

A. Trap-Seal Primer Systems:

1. Standard: ASSE 1044.
2. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
3. Cabinet: Surface-mounted steel box with stainless-steel cover.
4. 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.

5. Vacuum Breaker: ASSE 1001.
6. Number Outlets: Four or Six.
7. Size Outlets: NPS 1/2.

2.17 SPECIALTY VALVES:

- A. Comply with requirements for general-duty metal valves in Section 22 05 23 – VALVES FOR PLUMBING PIPING.

2.18 FLEXIBLE CONNECTORS:

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  1. Working-Pressure Rating: Minimum 200 psig.
  2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  1. Working-Pressure Rating: Minimum 200 psig.
  2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.19 EXPANSION TANKS:

- A. Expansion Tanks for Potable Water, ASME Rated:
  1. The expansion tank shall be carbon steel, thermal expansion, with a fixed bladder.
  2. The tank shall be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.
  3. Expansion tank shall be designed for commercial and industrial fresh potable hot water applications.
  4. Bladder: Fixed Butyl, FDA approved.
  5. Maximum Design Pressure: 150 PSI.
  6. Tank shall be pre-charged to 40 PSI.
  7. Tank Connections:
    - a. Top NPT stainless steel system connection.
    - b. Charging valve connection (standard tire valve for on-site charging to meet system requirements).

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in the 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.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves 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.
- E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and pump.
- F. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 – ROUGH CARPENTRY.
- G. Install hose stations 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 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 – ROUGH CARPENTRY.
- H. Install water-hammer arresters in water piping according to PDI-WH 201.
- I. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

- J. Install supply-type, trap-seal primer valves 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.
- K. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- L. Install trap-seal primer systems 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.

### 3.2 CONNECTIONS:

- A. Comply with requirements for ground equipment in Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Fire-retardant-treated-wood blocking is specified in Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES for electrical connections.

### 3.3 LABELING AND IDENTIFYING:

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Pressure vacuum breakers.
  - 2. Intermediate atmospheric-vent backflow preventers.
  - 3. Reduced-pressure-principle backflow preventers.
  - 4. Double-check, backflow-prevention assemblies.
  - 5. Water pressure-reducing valves.
  - 6. Calibrated balancing valves.
  - 7. Primary, thermostatic, water mixing valves.
  - 8. Manifold, thermostatic, water mixing-valve assemblies.
  - 9. Outlet boxes.
  - 10. Hose stations.
  - 11. Supply-type, trap-seal primer valves.
  - 12. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 00 50.

### 3.4 FIELD QUALITY CONTROL:

- A. Perform the following tests and inspections:
  - 1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 ADJUSTING:

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 11 22  
DOMESTIC WATER PUMPS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 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. Related Sections:

Section 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

Section 22 05 23 – VALVES FOR PLUMBING PIPING

Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 11 16 – DOMESTIC WATER PIPING

Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

1.3 SUMMARY:

- A. Section Includes:

1. In-line, sealless centrifugal pumps.

1.4 DEFINITIONS:

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.6 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE:

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.8 DELIVERY, STORAGE, AND HANDLING:

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

1.9 COORDINATION:

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.



## PART 2 - PRODUCTS

### 2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS:

- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- B. Pump Construction:
  - 1. 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.
  - 2. Casing: Bronze, with threaded or companion-flange connections.
  - 3. Impeller: Plastic.
  - 4. Motor: Single speed, unless otherwise indicated.

### 2.2 MOTORS:

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

### 2.3 CONTROLS:

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  - 1. Type: Water-immersion temperature sensor, for installation in piping.
  - 2. Range: 50 to 125 deg F.
  - 3. Enclosure: NEMA 250, Type 4X.
  - 4. Operation of Pump: On or off.
  - 5. Transformer: Provide if required.
  - 6. Power Requirement: 24 V, ac.
  - 7. Settings: Start pump at 110 deg F and stop pump at 120 deg F.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

### 3.2 PUMP INSTALLATION:

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.
  - 1. Comply with requirements for vibration isolation devices specified in Section 22 05 48. Fabricate brackets or supports as required.
  - 2. Comply with requirements for hangers and supports specified in Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- D. Install pressure switches in water supply piping.
- E. Install thermostats in hot-water return piping.

### 3.3 CONNECTIONS:

- A. Comply with requirements for piping specified in Section 22 11 16 – DOMESTIC WATER PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 22 05 23 – VALVES FOR PLUMBING PIPING, and comply with requirements for strainers specified in Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
  - 1. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tapings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- E. Connect thermostats to pumps that they control.

### 3.4 IDENTIFICATION:

- A. Comply with requirements for identification specified in Section 22 00 50 for identification of pumps.

### 3.5 STARTUP SERVICE:

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set thermostats for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

### 3.6 ADJUSTING:

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

## SECTION 22 11 23

### DOMESTIC-WATER PACKAGED BOOSTER PUMPS (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections: Refer to specification section 22 00 50 for related sections.

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Multiplex, variable-speed booster pumps.

1.4 DEFINITIONS:

- A. VFC: Variable-frequency controller(s).

1.5 PERFORMANCE REQUIREMENTS:

- A. Seismic Performance: Booster pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .
  - 1. The term "withstand" means "the booster pump will remain in place without separation of any parts from the booster pump when subjected to the seismic forces specified."

1.6 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For booster pumps. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

1.7 INFORMATIONAL SUBMITTALS:

- A. Seismic Qualification Certificates: For booster 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.

#### 1.8 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.

#### 1.9 QUALITY ASSURANCE:

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Comply with ASME B31.9 for piping.
- C. UL Compliance for Packaged Pumping Systems:
  - 1. UL 508, "Industrial Control Equipment."
  - 2. UL 508A, "Industrial Control Panels."
  - 3. UL 778, "Motor-Operated Water Pumps."
  - 4. UL 1995, "Heating and Cooling Equipment."
- D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

#### 1.10 DELIVERY, STORAGE, AND HANDLING:

- A. Retain protective coatings and flange's protective covers during storage.

#### 1.11 COORDINATION:

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 MULTIPLEX, VARIABLE-SPEED BOOSTER PUMPS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grundfos
  - 2. Armstrong Pumps, Inc.
  - 3. Beel & Gossett: a Xylem Brand.
  - 4. Towle Whitney
- B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.
- C. Pumps:
  - 1. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
  - 2. Casing: Radially split; cast iron.
  - 3. Impeller: Closed, stainless; statically and dynamically balanced and keyed to shaft.
  - 4. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
  - 5. Seal: Mechanical.
  - 6. Orientation: Mounted vertically.
- D. Motors: Single speed, with [**grease-lubricated**] [or] [**pre-greased, permanently shielded**], ball-type bearings. Select motors that will not overload through full range of pump performance curve.
- E. Piping: Copper tube and copper fittings.
- F. Valves:
  - 1. Shutoff Valves NPS 2 and Smaller: ***two-piece, full-port ball valve***, in each pump's suction and discharge piping.
  - 2. Shutoff Valves NPS 2-1/2 and Larger: Gate valve or lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers.
  - 3. Check Valves NPS 2 and Smaller: **Silent** type in each pump's discharge piping.
  - 4. Check Valves NPS 2-1/2 and Larger: Silent type in each pump's discharge piping.
  - 5. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

- G. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
- H. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, variable-speed operation, with load control and protection functions.
  - 1. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in controller. Install VFC for pump motors larger than 25 hp in separate panel; same type as motor control panel enclosure.
  - 2. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.
    - a. Control Voltage: **[24] [120]**-V ac, with integral control-power transformer.
  - 3. Enclosure: NEMA 250, **[Type 1] [Type 3R] [Type 4] [Type 12] <Insert type>**.
  - 4. Motor Overload Protection: Overload relay in each phase.
  - 5. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.
    - a. Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.
    - b. Triplex, Sequence (Lead-Lag-Lag) Starter: Switches lead pump to one lag main pump and to three-pump operation.
  - 6. Pump Operation and Sequencing: **[Pressure-sensing method] [or] [flow-sensing method] [Pressure-sensing method for lead pump and flow-sensing method for lag pumps]**.
    - a. Time Delay: Controls pump on-off operation; adjustable from **[1 to 300] <Insert value>** seconds.
  - 7. VFC: Voltage-source, pulse-width, modulating-frequency converter for **[each] [lead]** pump.
  - 8. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
  - 9. Instrumentation: Suction and discharge pressure gages.
  - 10. Lights: Running light for each pump.
  - 11. Alarm Signal Device: Sounds alarm when backup pumps are operating.
    - a. Time Delay: Controls alarm operation; adjustable from **[1 to 300] <Insert value>** seconds, with **[automatic] [manual]** reset.
  - 12. Thermal-bleed cutoff.



13. [Low-suction-pressure] [Water-storage-tank, low-level] cutout.
14. High-suction-pressure cutout.
15. Low-discharge-pressure cutout.
16. High-discharge-pressure cutout.
17. Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to **BACnet** DDC system. DDC systems are specified in Section 23 09 23 – DIRECT DIGITAL CONTROL (DDC) SYSTEMS FOR HVAC. Include the following:
  - a. On-off status of each pump.
  - b. Alarm status.

I. Base: Structural steel.

## 2.2 MOTORS:

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
  1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

### 3.2 INSTALLATION:

- A. Equipment Mounting:

1. Install booster pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 – CAST-IN-PLACE CONCRETE.
  2. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Support connected domestic-water piping so weight of piping is not supported by booster pumps.

### 3.3 CONNECTIONS:

- A. Comply with requirements for piping specified in Section 22 11 16 – DOMESTIC WATER PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers.
1. Install shutoff valves on piping connections to booster-pump suction and discharge headers. Install ball, butterfly, or gate valves same size as suction and discharge headers. Comply with requirements for general-duty valves specified in Section 22 05 23 – VALVES FOR PLUMBING PIPING,.
  2. Install union, flanged, or grooved-joint connections on suction and discharge headers at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Section 22 11 16 – DOMESTIC WATER PIPING.
  3. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge headers. Comply with requirements for domestic-water piping specified in Section 22 11 16 – DOMESTIC WATER PIPING.
  4. Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge headers. Comply with requirements for flexible connectors specified in Section 22 11 16 – DOMESTIC WATER PIPING.
  5. Install piping adjacent to booster pumps to allow service and maintenance.

### 3.4 IDENTIFICATION:

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 50 – BASIC PLUMBING REQUIREMENTS.

### 3.5 FIELD QUALITY CONTROL:

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Perform visual and mechanical inspection.
  - 2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Pumps and controls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 STARTUP SERVICE:

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING:

- A. Adjust booster pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust pressure set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION:

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION

## SECTION 22 13 16

### SANITARY WASTE AND VENT PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 22 05 23 – VALVES FOR PLUMBING PIPING

Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

Section 31 00 00 – EARTHWORK

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.

#### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
- B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. 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.
- B. Field quality-control reports.

#### 1.6 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 according to requirements indicated:
  - 1. Notify Construction Manager 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 Construction Manager's written permission.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS:

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 2.2 PIPING MATERIALS:

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. 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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS:

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS:

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and ASTM C 1540.
  - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- E. Cast-Iron, Hubless-Piping Couplings:
  - 1. Standard: ASTM C 1277.
  - 2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.5 COPPER TUBE AND FITTINGS:

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Copper Pressure Fittings:
  - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.6 SPECIALTY PIPE FITTINGS:

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 2. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  - 3. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.



- b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
  - 4. Pressure Transition Couplings:
    - a. Standard: AWWA C219.
    - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    - c. Center-Sleeve Material: Manufacturer's standard Malleable iron.
    - d. Gasket Material: Natural or synthetic rubber.
    - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
- 1. Dielectric Unions:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 125 psig minimum at 180 deg F.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  - 2. Dielectric Flanges:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Factory-fabricated, bolted, companion-flange assembly.
      - 3) Pressure Rating: 125 psig minimum at 180 deg F.
      - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
  - 3. Dielectric-Flange Insulating Kits:
    - a. Description:
      - 1) Nonconducting materials for field assembly of companion flanges.
      - 2) Pressure Rating: 150 psig.
      - 3) Gasket: Neoprene or phenolic.
      - 4) Bolt Sleeves: Phenolic or polyethylene.
      - 5) Washers: Phenolic with steel backing washers.
  - 4. Dielectric Nipples:
    - a. Description:

- 1) Standard: IAPMO PS 66.
- 2) Electroplated steel nipple.
- 3) Pressure Rating: 300 psig at 225 deg F.
- 4) End Connections: Male threaded or grooved.
- 5) Lining: Inert and noncorrosive, propylene.

## 2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING:

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

## PART 3 - EXECUTION

### 3.1 EARTH MOVING:

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

### 3.2 PIPING INSTALLATION:

- 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 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- L. Lay buried building 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. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Horizontal Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Plumbing Specialties:
  1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Comply with requirements for cleanouts specified in Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES.
  2. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES.
- 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 22 00 50.
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
  1. Comply with requirements for sleeve seals specified in Section 22 00 50.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  1. Comply with requirements for escutcheons specified in Section 22 00 50.
- 3.3 JOINT CONSTRUCTION:
  - A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  - B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
  - C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
  - D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
    1. Cut threads full and clean using sharp dies.

2. 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 unless dry seal threading is specified.
  - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
  - c. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION:

#### A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded or Shielded, non-pressure transition couplings.

#### B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.5 VALVE INSTALLATION:

- A. Comply with requirements in Section 22 05 23 – VALVES FOR PLUMBING PIPING for general-duty valve installation requirements.

### 3.6 HANGER AND SUPPORT INSTALLATION:

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 – 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 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.

- J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

### 3.7 CONNECTIONS:

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.8 IDENTIFICATION:

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 22 00 50.

### 3.9 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 according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - 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 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-foot 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.

### 3.10 CLEANING AND PROTECTION:

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.11 PIPING SCHEDULE:

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Aboveground, vent piping shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  4. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- E. Underground, soil, waste, and vent piping shall be any of the following:
  1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
4. Use Extra Heavy class cast-iron soil, waste, and vent piping for all areas with garage door (Vehicle Storage, Shops, Maintenance, Wash Bay). In areas without garage door Service class cast-iron piping can be used.

END OF SECTION

## SECTION 22 13 19

### SANITARY WASTE PIPING SPECIALTIES (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 07 62 00 – SHEET METAL FLASHING AND TRIM

Section 07 84 43 – JOINT FIRESTOPPING

Section 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 13 16 – SANITARY WASTE AND VENT PIPING

Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

##### 1.3 SUMMARY:

- A. Section Includes:

1. Cleanouts.
2. Roof flashing assemblies.
3. Through-penetration firestop assemblies.
4. Miscellaneous sanitary drainage piping specialties.

#### 1.4 ACTION SUBMITTALS:

##### A. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.
2. Wiring Diagrams: Power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS:

##### A. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS:

- ##### A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTIONS:

- ##### A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- ##### B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

#### 2.2 CLEANOUTS:

##### A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: As required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

##### B. Cast Brass Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Cast brass as required to match connected piping.
4. Closure: Polished nickel-bronze top.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M cast-iron soil pipe with cast-iron ferrule heavy-duty, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Body or Ferrule: Cast iron.
4. Clamping Device: Required.
5. Closure: Brass plug with threads and gasket.
6. Frame and Cover Shape: Round.
7. Top Loading Classification: Extra Heavy or Medium Duty as indicated.
8. Riser: ASTM A 74, Extra-Heavy or Service class, cast-iron drainage pipe fitting and riser to cleanout.

D. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: As required to match connected piping.
4. Closure Plug:
  - a. Brass.
  - b. Countersunk or raised head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

E. Medium-Duty Cleanouts:

1. Medium duty cleanouts shall be installed in Admin areas and Mechanical rooms.

F. Extra Heavy-Duty Cleanouts:

1. Extra heavy-duty cleanouts shall be installed in the Vehicle Storage, Maintenance, and Wash Bay areas and at exterior locations.
2. Cleanout shall be able to withstand heavy load traffic.

## 2.3 ROOF FLASHING ASSEMBLIES:

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

- a. Open-Top Vent Cap: Without cap.

## 2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES:

### A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

## 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES:

### A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping.

### B. 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: 4-inch-minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

### C. 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.

### D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

A. Equipment Mounting:

1. Comply with requirements for vibration-isolation and seismic-control devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Division 07.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Division 07.
- G. Install through-penetration firestop assemblies in metal conductors and stacks at floor penetrations.
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. 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.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on vent pipe passing through roof if indicated.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.



- Q. Install wood-blocking reinforcement for wall-mounting-type specialties.
- R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.2 CONNECTIONS:

- A. Comply with requirements in Section 22 13 16 – SANITARY WASTE AND VENT PIPING for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- D. Connect wiring according to Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

### 3.3 FLASHING INSTALLATION:

- A. Comply with requirements in Division 07.
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07.

### 3.4 LABELING AND IDENTIFYING:

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
  - 1. Nameplates and signs are specified in Section 22 00 50.

### 3.5 FIELD QUALITY CONTROL:

- A. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.6 PROTECTION:

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 20  
SANITARY DRAINS  
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 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. Related Sections:
  - Section 22 13 16 – SANITARY WASTE AND VENT PIPING
  - Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES
  - Section 22 13 23 – SANITARY WASTE INTERCEPTORS

1.3 SUMMARY:

- A. Section Includes:
  - 1. Floor drains.
  - 2. Floor sinks.
  - 3. Trench drains.
  - 4. Channel drainage systems.

1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 DRAIN ASSEMBLIES:

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

### 2.2 FLOOR DRAINS:

#### A. Cast-Iron Floor Drains:

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. WATTS; A Watts Water Technologies Company.
  - d. Zurn Industries, LLC.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Cast iron.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Backwater Valve: Not required.
9. Coating on Interior and Exposed Exterior Surfaces: Epoxy coated.
10. Sediment Bucket: Required for medium-duty and heavy-duty floor drains.
11. Top or Strainer Material: Bronze or Nickel bronze.
12. Top Shape: Round.
13. Top Loading Classification: Heavy Duty, Light Duty, or Medium Duty as indicated on the Contract Drawings.
14. Funnel: Not required.
15. Trap Material: Cast iron or Copper.
16. Trap Pattern: Standard P-trap.
17. Trap Features: Trap-seal primer valve drain connection.

#### B. Light-Duty Floor Drains:

1. Epoxy coated cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, seepage slots, type BZ polished nickel bronze, light-duty, leveling strainer, trap primer connection.
2. Strainer: Nickel-bronze, round, 5-inch diameter top, round.

#### C. Medium-Duty Floor Drains:

1. Floor drain, 9 in. diameter top, dura coated cast iron body bottom outlet, seepage pan, combination membrane flashing clamp, frame for medium-duty, cast iron, heel-proof slotted grate, sediment bucket, cast iron grate, trap primer connection.
2. Strainer: Cast iron, round, 9-inch diameter top.

D. Heavy-Duty Floor Drains:

1. Cast iron body, galvanized, with sediment bucket, bottom outlet.
2. Strainer: Ductile iron, heavy duty, round or square, 16-inch, secured.

2.3 FLOOR SINKS:

A. Stainless-Steel Floor Sinks, ASME A112.6.7:

1. Standard: ASME A112.6.7.
2. Pattern: Floor drain.
3. Body Material: Stainless steel, Type 304, 14 gauge.
4. Anchor Flange: Required.
5. Outlet: Bottom, no-hub connection.
6. Internal Strainer: Dome.
7. Internal Strainer Material: Stainless steel.
8. Top Grate Material: Stainless steel, loose.
9. Top of Body and Grate Finish: Stainless steel.
10. Top Shape: Square.
11. Dimensions of Top Grate: 12 inch by 12 inch, 8 inch deep.
12. Top Loading Classification: No traffic.

2.4 TRENCH DRAINS:

A. Trench Drains:

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. Sioux Chief Manufacturing Company, Inc.
  - d. WATTS; A Watts Water Technologies Company.
  - e. Zurn Industries, LLC.
2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchors and setting devices. Manufacturer's standard, unless indicated otherwise.
5. Clamping Device: Required.

6. Outlet: Bottom, end, or side. As indicated on Contract Drawings
7. Grate Material: Ductile iron, with slots or perforations.
8. Grate Finish: Not required.
9. Top Loading Classification: Heavy duty, or extra heavy duty.
  - a. Certification: ASTM A536 Grade 80-55-06.
  - b. Material: Ductile iron slotted grate, 4.5 lbs per linear foot, heavy-duty, H-20 load rated.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

## 2.5 CHANNEL DRAINAGE SYSTEMS:

### A. HDPE or PP Channel Drainage 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. Jay R. Smith Mfg Co; a division of Morris Group International.
  - b. Sioux Chief Manufacturing Company, Inc.
  - c. WATTS; A Watts Water Technologies Company.
  - d. Zurn Industries, LLC.
2. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
  - a. Channel Sections: Interlocking-joint, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with sloped invert and with outlets in number, sizes, and locations indicated.
    - 1) Dimensions: Width as indicated on Contract Drawings. Include number of units required to form total lengths indicated.
  - b. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
    - 1) Material: Ductile Iron heavy duty, H-20 load rated.
  - c. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
  - d. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  - 3. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 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.
- B. Install trench drains at low points of surface areas to be drained.
  - 1. Set grates of drains flush with finished surface, unless otherwise indicated.
- C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.
  - 1. Install on support devices, so that top will be flush with adjacent surface.
- D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.
- E. Install open drain fittings with top of hub 2 inches above floor.

### 3.2 CONNECTIONS:

- A. Comply with requirements in Section 22 13 16 – SANITARY WASTE AND VENT PIPING for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Comply with requirements in Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Comply with requirements in Section 22 13 23 – SANITARY WASTE INTERCEPTORS for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.
- D. Install piping adjacent to equipment to allow service and maintenance.
- E. Ground equipment according to Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- F. Connect wiring according to Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

### 3.3 LABELING AND IDENTIFYING:

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS.

### 3.4 PROTECTION:

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



## SECTION 22 13 23

### SANITARY WASTE INTERCEPTORS (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections: See Section References for each Division in Section 22 00 50.

Section 22 13 16 – SANITARY WASTE AND VENT PIPING

Division 31 - EARTHWORK

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Gas/Oil Separators.

##### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of concrete manhole interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, design calculations, concrete design mix reports, furnished specialties, and accessories.
2. Provide buoyancy calculations if requested by the Engineer.

#### 1.5 INFORMATIONAL SUBMITTALS:

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Piping connections. Include size, location, and elevation of each.
  2. Interface with underground structures and utility services.

#### 1.6 FIELD CONDITIONS:

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
  1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
  2. Do not proceed with interruption of sewer services without Owner's written permission.

### PART 2 - PRODUCTS

#### 2.1 GAS/OIL INTERCEPTORS:

- A. Manholes and precast concrete structures shall be constructed as shown on Drawings. Conform accurately to indicated dimensions.
  1. Precast concrete manhole barrel, base, and cone sections shall conform to ASTM C478. Joint sealant will be in accordance with ASTM C990, butyl rubber. Increase thickness of precast concrete sections or add concrete to base section as required to prevent floatation.

Interceptor shall be furnished complete with integral steps that shall conform to ASTM C478 requirements. Steps shall be fabricated either of extruded aluminum or steel reinforced plastic. Steps shall be uniformly spaced at a maximum of 12-inches unless otherwise shown on the drawings.

2. Brick for constructing channels and adjustments to grade shall be waterstruck sewer brick, Grade 'A' concrete brick conforming to ASTM C-55, or precast concrete grade rings mortared in place.
  3. Cement mortar for parging and for joining brick shall be made of one (1) part Portland cement and two (2) parts sand mixed to the proper consistency. Add approximately twenty (20) pounds of hydrated lime for each sack of cement.
  4. Precast concrete structures for oil/gas separator shall be as manufactured by A. Rotondo & Sons, Inc. by Scituate Concrete pipe or Shea precast, or equal. Structures shall conform to the form and dimensions shown, be reinforced with ASTM A615 Grade 60 reinforcing steel having a minimum 1-inch cover and constructed of 4,000 PSI at 28 days concrete. All field joints shall be sealed with rubber gasket and shall be grouted with hydraulic cement for watertightness. Design loading for all structures shall meet H-20 wheel loading design.
- B. Conform to the Concrete Section of the specification for 4,000 PSI 6 percent air entrained concrete for all concrete structures for the work of this section. Including reinforcing steel where required.
- C. Precast sections shall be manufactured to contain wall opening of the minimum size to receive the ends of the pipes, such openings being accurately set to conform with line and grade of the sewer or drain. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted except as required by the Engineer.
- D. No more than two lift holes may be cast or drilled in each section. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- E. The exterior of all precast manhole bases, walls and cones shall be given a minimum of one shop coat of bituminous damp-proofing.
- F. Cast iron manholes, frames, and covers, shall be of the form, dimensions, and manufacture shown on the Contract Drawings. Manhole extensions shall be neatly and accurately brought to dimensions of the base of the frame. Casting shall be of tough gray iron, free from cracks, holes, and cold shuts. All castings shall be made accurately to dimensions and shall be machined to provide even bearing surfaces. Covers must fit the frames in any position and, if found to rattle under traffic, shall be replaced. Filling to obtain tight covers will not be permitted. No plugging, burning-in, or filling will be allowed. All castings shall be carefully coated inside and out with coal tar pitch varnish of approved quality.
- G. Castings shall be as detailed on drawings or castings that appear on the Massachusetts Highway Department approval list for manhole frame & cover castings. Castings shall be by LeBaron Foundry, Neenah Foundry, or Campbell Foundry.

## PART 3 - EXECUTION

### 3.1 EARTHWORK:

- A. Excavating, trenching, and backfilling are specified in Division 31.

### 3.2 INSTALLATION:

- A. Install precast concrete interceptors according to ASTM C 891.
- B. Set interceptors level and plumb.
- C. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
- D. Set tops of manhole frames and covers flush with finished surface in pavements.
  - 1. Set tops 3-inches above finish surface elsewhere unless otherwise indicated.
- E. Set tops of grating frames and grates flush with finished surface.
- F. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- G. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet.
  - 1. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

### 3.3 CONNECTIONS:

- A. Piping installation requirements are specified in Section 22 13 16 – SANITARY WASTE AND VENT PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

### 3.4 IDENTIFICATION:

- A. Identification materials and installation are specified in Division 31.
  - 1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
  - 2. Use warning tapes or detectable warning tape over ferrous piping.

3. Use detectable warning tape over nonferrous piping and over edges of underground structures.
- B. The surface of the manhole covers shall have a diamond pattern with the cast words "OIL SEPARATOR".

### 3.5 TESTING:

- A. Do not enclose, cover or put into service before inspection and approval. Test completed piping systems in accordance with requirements for authority having jurisdiction. Schedule tests and inspections by authorities having jurisdiction with at least 48 hours advance notice. Submit report for each test.
- B. Gas/Oil Separator Manhole Exfiltration Test:
  1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than 2 hours to ensure there is no leakage into manhole.
  2. Fill manhole with water to within 4-inches of top of cover frame. Prior to test, allow manhole to soak from minimum of 4 hours to maximum of 72 hours; after soak period, adjust water level inside manhole to within 4-inches of top of cover frame.
  3. Measure water level from top of manhole frame; at end of 4-hour test period, again measure water level from top of manhole frame; there shall be no drop in water level during test period.
  4. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria, repair visible leaks regardless of quantity of leakage.

### 3.6 PROTECTION:

- A. Protect sanitary waste interceptors from damage during construction period.
- B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION

## SECTION 22 14 13

### FACILITY STORM DRAINAGE PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 14 23 – STORM DRAINAGE PIPING SPECIALTIES

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.

##### 1.4 PERFORMANCE REQUIREMENTS:

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.
  - B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- 1.5 ACTION SUBMITTALS:
- A. Product Data: For each type of product indicated.
- 1.6 INFORMATIONAL SUBMITTALS:
- A. Seismic Qualification Certificates: For storm drainage 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 equipment anchorage devices on which the certification is based and their installation requirements.
  - B. Field quality-control reports.
- 1.7 QUALITY ASSURANCE:
- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- 1.8 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 Construction Manager no fewer than two days in advance of proposed interruption of storm-drainage service.
    2. Do not proceed with interruption of storm-drainage service without Construction Manager's written permission.

## PART 2 - PRODUCTS

### 2.1 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.

## 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS:

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and ASTM C 1540.
  - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Cast-Iron, Hubless-Piping Couplings:
  - 1. Standard: ASTM C 1277.
  - 2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 SPECIALTY PIPE FITTINGS:

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.



- 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
  2. Dielectric Unions:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 150 psig at 180 deg F.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  3. Dielectric Flanges:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Factory-fabricated, bolted, companion-flange assembly.
      - 3) Pressure Rating: 150 psig.
      - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
  4. Dielectric Nipples:
    - a. Description:
      - 1) Electroplated steel nipple complying with ASTM F 1545.
      - 2) Pressure Rating: 300 psig at 225 deg F.
      - 3) End Connections: Male threaded or grooved.
      - 4) Lining: Inert and noncorrosive, propylene.

## 2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING:

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: High-density, cross laminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.
- C. Form: Sheet or tube.

- D. Color: Black or natural.

### PART 3 - EXECUTION

#### 3.1 EARTH MOVING:

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

#### 3.2 PIPING INSTALLATION:

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
- J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place

hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- N. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 14 23 – STORM DRAINAGE PIPING SPECIALTIES.
  - 2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 14 23 – STORM DRAINAGE PIPING SPECIALTIES.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 00 50.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 00 50.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 00 50.

### 3.3 JOINT CONSTRUCTION:

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

- C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION:

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.
  - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force-Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
  - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
  - 3. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flanges.

### 3.5 HANGER AND SUPPORT INSTALLATION:

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS:

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- D. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.7 IDENTIFICATION:

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 22 00 50.

### 3.8 FIELD QUALITY CONTROL:

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. 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 storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

### 3.9 CLEANING:

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.10 PIPING SCHEDULE:

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
  - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, cast-iron, hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

## SECTION 22 14 23

### STORM DRAINAGE PIPING SPECIALTIES (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 22 14 13 – FACILITY STORM DRAINAGE PIPING

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Miscellaneous storm drainage piping specialties.
  - 2. Cleanouts.

##### 1.4 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated.

##### 1.5 QUALITY ASSURANCE:

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.



## PART 2 - PRODUCTS

### 2.1 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES:

#### A. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

### 2.2 CLEANOUTS:

#### A. Floor Cleanouts:

1. Standard: ASME A112.36.2M, for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanouts.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule Material: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Inside calk or Spigot.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top-Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

#### B. Wall Cleanouts:

1. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or Hubless, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

### 2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES:

#### A. Through-Penetration Firestop Assemblies:

1. Standard: ASTM E 814, for through-penetration firestop assemblies.

2. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
3. Size: Same as connected pipe.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate cleanouts at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install test tees in vertical conductors and near floor.
- F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- G. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- H. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

#### 3.2 CONNECTIONS:

- A. Comply with requirements for piping specified in Section 22 14 13 – FACILITY STORM DRAINAGE PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.3 FLASHING INSTALLATION:

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 PROTECTION:

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

## SECTION 22 15 13

### GENERAL-SERVICE COMPRESSED-AIR PIPING (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

Section 22 05 23 – VALVES FOR PLUMBING PIPING

Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 15 19 – GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

##### 1.3 SUMMARY:

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig or less.

#### 1.4 DEFINITIONS:

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. HDPE: High-density polyethylene plastic.
- E. NBR: Acrylonitrile-butadiene rubber.
- F. PE: Polyethylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.
- I. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

#### 1.5 PERFORMANCE REQUIREMENTS:

- A. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

#### 1.6 ACTION SUBMITTALS:

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Flexible pipe connectors.
  - 3. Safety valves.
  - 4. Pressure regulators. Include rated capacities and operating characteristics.
  - 5. Automatic drain valves.
  - 6. Filters. Include rated capacities and operating characteristics.
  - 7. Lubricators. Include rated capacities and operating characteristics.
  - 8. Quick couplings.
  - 9. Hose assemblies.

#### 1.7 INFORMATIONAL SUBMITTALS:

- A. Brazing and welding certificates.
- B. Qualification Data: For Installers.

- C. Field quality-control test reports.

#### 1.8 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.9 QUALITY ASSURANCE:

- A. Installer Qualifications:

1. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by T-DRILL Industries Inc., for making branch outlets.
2. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.

- B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

- D. ASME Compliance:

1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
2. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

#### 1.10 PROJECT CONDITIONS:

- A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of compressed-air service.
2. Do not proceed with interruption of compressed-air service without Construction Manager's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS:

- A. Copper Tube: ASTM B 88, Type K or L seamless, drawn-temper, water tube.
  - 1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
  - 2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
  - 3. Copper Unions: ASME B16.22 or MSS SP-123.
  - 4. Press-Type Fittings, NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
  - 5. Press-Type Fittings, NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
  - 6. Extruded-Tee Outlets: Procedure for making branch outlets in copper tube according to ASTM F 2104.
- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.2 JOINING MATERIALS:

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.3 VALVES:

- A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 22 05 23 – VALVES FOR PLUMBING PIPING.

## 2.4 DIELECTRIC FITTINGS:

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 150 psig.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 150 psig.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.

## 2.5 FLEXIBLE PIPE CONNECTORS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: 200 psig minimum.
  - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.



1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

## 2.6 SPECIALTIES:

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
  1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
  1. Type: Pilot operated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- D. Air-Line Pressure Regulators: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- E. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.
- F. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.
- G. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.
- H. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.
  1. Provide with automatic feed device for supplying oil to lubricator.

## 2.7 QUICK COUPLINGS:

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
  - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
  - 2. Plug End: With barbed outlet for attaching hose.
- C. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
  - 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
  - 2. Plug End: With barbed outlet for attaching hose.

## 2.8 HOSE ASSEMBLIES:

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
  - 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
  - 2. Hose Clamps: Stainless-steel clamps or bands.
  - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
  - 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

## 2.9 HOSE REELS

- A. Description: Compressed Air Hose Reels shall be Lincoln Model No. 85010-50 low pressure wheel for air with all accessories as required for a complete compressor reel assembly as manufactured by Lincoln Industrial, St. Louis, MO: or Alemite or Graco.
  - 1. Fifty feet of ½ inch air hose
  - 2. Reel latch that automatically locks at desired position.
  - 3. Air chuck attachment for tire, Lincoln Model No. 6691 hand held meter.
  - 4. Ball stop included.
  - 5. Maximum Pressure: 350 psi.
  - 6. Material Inlet/Outlet: ½ NPT (female).

7. Sheave width: 4-1/2 inches.
8. Sheave diameter: 19-1/2 inches.
9. Drum diameter: 12-5/8 inches.
10. Overall width: 6-5/8 inches.
11. Overall height: 23-3/4 inches.
12. Overall depth: 19- 3/4 inches.

### PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS:

- A. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
  1. Type K or L, copper tube; wrought-copper fittings; and brazed or soldered joints.
  2. Type K or L, copper tube; press-type fittings; and pressure-sealed joints.
- B. High-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
  1. Type K or L, copper tube; wrought-copper fittings; and brazed or soldered joints.
- C. Drain Piping: Use the following piping materials:
  1. Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

#### 3.2 VALVE APPLICATIONS:

- A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Articles in Section 22 05 23 – VALVES FOR PLUMBING PIPING according to the following:
  1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
  2. High-Pressure Compressed Air: Valve types specified for medium-pressure compressed air.
  3. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

#### 3.3 PIPING INSTALLATION:

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design

considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
  - 1. Use steel companion flange with gasket for connection to steel pipe.
  - 2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Flanged joints may be used instead of specified joint for any piping or tubing system.
- J. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, according to Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F 2144.
- K. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- L. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- M. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- N. Install piping to permit valve servicing.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.

- Q. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS..
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS..

#### 3.4 JOINT CONSTRUCTION:

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Extruded-Tee Outlets for Copper Tubing: Form branches according to ASTM F 2014, with tools recommended by procedure manufacturer, and using operators qualified according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- H. Pressure-Sealed Joints: Join with tools recommended by fitting manufacturer, using operators qualified according to Part 1 "Quality Assurance" Article.

- I. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

### 3.5 VALVE INSTALLATION:

- A. General-Duty Valves: Comply with requirements in Section 22 05 23 – VALVES FOR PLUMBING PIPING.
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

### 3.6 DIELECTRIC FITTING INSTALLATION:

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 and Smaller: Use dielectric unions.
- C. NPS 2-1/2 to NPS 4: Use dielectric flanges.

### 3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION:

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

### 3.8 SPECIALTY INSTALLATION:

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment and tools.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

- E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.
- F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.
- G. Install air-line lubricators in branch piping to machine tools. Mount on wall at locations indicated.
- H. Install quick couplings at piping terminals for hose connections.
- I. Install hose assemblies at hose connections.

### 3.9 CONNECTIONS:

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

### 3.10 HANGER AND SUPPORT INSTALLATION:

- A. Comply with requirements in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT for seismic-restraint devices.
- B. Comply with requirements in Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
  - 1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
  - 2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1/4: 60 inches with 3/8-inch rod.
  - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
  - 3. NPS 3/4: 84 inches with 3/8-inch rod.
  - 4. NPS 1: 96 inches with 3/8-inch rod.
  - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
  - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
  - 7. NPS 2: 11 feet with 3/8-inch rod.
  - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
  - 9. NPS 3: 14 feet with 1/2-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

### 3.11 LABELING AND IDENTIFICATION:

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS.

### 3.12 FIELD QUALITY CONTROL:

- A. Perform field tests and inspections.
- B. Tests and Inspections:
  - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop-in pressure.
  - 2. Repair leaks and retest until no leaks exist.
  - 3. Inspect filters, lubricators, and pressure regulators for proper operation.
- C. Prepare test reports.

END OF SECTION



## SECTION 22 15 19

### GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:

Section 01 40 00 – QUALITY REQUIREMENTS

Section 03 30 00 – CAST-IN-PLACE CONCRETE

Section 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Section 22 15 13 – GENERAL-SERVICE COMPRESSED-AIR PIPING

##### 1.3 SUMMARY:

- A. Section Includes:

- 1. Oil-flooded, rotary-screw air compressors.
- 2. Inlet-air filters.
- 3. Air-cooled, compressed-air aftercoolers.
- 4. Refrigerant compressed-air dryers.
- 5. Computer interface cabinet.

1.4 DEFINITIONS:

- A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm.
- B. Standard Air: Free air at 68 deg F and 1 atmosphere before compression or expansion and measured in scfm.

1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product.
  - 1. 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. Delegated-Design Submittal: For compressed-air equipment mounting.
  - 1. Detail fabrication and assembly of supports.
  - 2. Include design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.6 INFORMATIONAL SUBMITTALS:

- A. Seismic Qualification Certificates: For compressed-air 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.

1.7 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For compressed-air equipment to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS:

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Air-Compressor, Inlet-Air-Filter Elements: Equal to 100 percent of amount installed.
  - 2. Belts: Two for each belt-driven compressor.

1.9 FIELD CONDITIONS:

- A. Interruption of Existing Compressed-Air Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of compressed-air service.
  - 2. Do not proceed with interruption of compressed-air service without Construction Manager's written permission.

1.10 COORDINATION:

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION:

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 PERFORMANCE REQUIREMENTS:

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01, to design compressed-air equipment mounting.
- B. Seismic Performance: Compressed-air equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

## 2.3 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS:

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
  1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
  2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
  3. Control Voltage: 120-V ac or less, using integral control power transformer.
  4. Motor Overload Protection: Overload relay in each phase.
  5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
  6. Automatic control switches to air compressors.
  7. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
  8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
  2. Interior Finish: Corrosion-resistant coating.
  3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
- D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

## 2.4 OIL-FLOODED, ROTARY-SCREW AIR COMPRESSORS:

- 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. Atlas Copco.
2. CompAir, Ltd.
3. Quincy Compressor.
4. Sullair Corporation.

B. Compressor(s): Oil-flooded, rotary-screw type with lubricated helical screws and lubricated gear box.

1. Coupling: Nonlubricated, flexible type.
2. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package prepiped to unit; with air pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal bypass valve.
3. Air Filter: Dry type, with maintenance indicator and cleanable, replaceable filter element.
4. Air/Coolant Receiver and Separation System: 150-psig-rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal bypass valve.
5. Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 50 and 100 psig. Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.

## 2.5 INLET-AIR FILTERS:

A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.

1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.

1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
2. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

## 2.6 AIR-COOLED, COMPRESSED-AIR AFTERCOOLERS:

A. Description: Electric-motor-driven, fan-operation, finned-tube unit; rated at 250 psig and leak tested at 350-psig minimum air pressure; in capacities indicated. Size units to

cool compressed air in compressor-rated capacities to 10 deg F above summertime maximum ambient temperature. Include moisture separator and automatic drain.

## 2.7 REFRIGERANT COMPRESSED-AIR DRYERS:

- A. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F, 100-psig air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.

## 2.8 COMPUTER INTERFACE CABINET:

- A. Description:
  - 1. Wall mounting.
  - 2. Welded steel with white enamel finish.
  - 3. Gasketed door.
  - 4. Grounding device.
  - 5. Factory-installed, signal circuit boards.
  - 6. Power transformer.
  - 7. Circuit breaker.
  - 8. Wiring terminal board.
  - 9. Internal wiring capable of interfacing 20 alarm signals.

## 2.9 MOTORS:

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 22 05 13 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load does not require motor to operate in service factor range above 1.0.

# PART 3 - EXECUTION

## 3.1 EQUIPMENT INSTALLATION:

- A. Equipment Mounting:
  - 1. Install air compressors, aftercoolers, and air dryers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03.

2. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Install compressed-air equipment anchored to substrate.
  - C. Arrange equipment so controls and devices are accessible for servicing.
  - D. Maintain manufacturer's recommended clearances for service and maintenance.
  - E. Install the following devices on compressed-air equipment:
    1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
    2. Pressure Regulators: Install downstream from air compressors and dryers.
    3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

### 3.2 CONNECTIONS:

- A. Comply with requirements for piping specified in Section 22 15 13 – GENERAL-SERVICE COMPRESSED-AIR PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to machine, allow space for service and maintenance.

### 3.3 IDENTIFICATION:

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 22 00 50.

### 3.4 STARTUP SERVICE:

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks according to manufacturer's written instructions.
  2. Check for lubricating oil in lubricated-type equipment.
  3. Check belt drives for proper tension.
  4. Verify that air-compressor inlet filters and piping are clear.
  5. Check for equipment vibration-control supports and flexible pipe connectors, and verify that equipment is properly attached to substrate.
  6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure, but not higher than rating of system components.
  7. Check for proper seismic restraints.
  8. Drain receiver tanks.

9. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
10. Test and adjust controls and safeties.

3.5 DEMONSTRATION:

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air compressors, aftercoolers, and air dryers.

END OF SECTION



## SECTION 22 33 00

### ELECTRIC, DOMESTIC-WATER HEATERS (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections: Refer to specification section 22 00 50 for related sections.

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Commercial, heat pump, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

#### 1.4 PERFORMANCE REQUIREMENTS:

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces."

#### 1.5 ACTION SUBMITTALS:

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### 1.6 INFORMATIONAL SUBMITTALS:

- A. Seismic Qualification Certificates: For commercial 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.
- B. Product Certificates: For each type of commercial, electric, domestic-water heater, from manufacturer.

- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE:

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: 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.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.9 COORDINATION:

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.10 WARRANTY:

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, 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, Electric, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Five years.
      - 2) Controls and Other Components: Three years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

### 2.1 COMMERCIAL, HEAT PUMP DOMESTIC-WATER HEATERS:

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- A. Commercial, Heat Pump, Domestic-Water Heaters:
  - 1. The Heat Pump shall be a Lochinvar Model WHP125, or an approved equal.
  - 2. The Heat Pump shall have a scroll compressor, factory charged with R513A refrigerant NSF61 approved stainless steel circulator pump, and double wall stainless steel condenser for potable water applications. The complete pump assembly shall carry a one year limited warranty. The unit shall be equipped with a stainless steel single wall heat exchanger evaporator.
  - 3. The Heat Pump refrigerant circuit shall contain an adjustable thermal expansion valve, receiver, accumulator, serviceable filter drier and service ports for indoor and outdoor installation.
  - 4. The Heat Pump shall be constructed with a heavy aluminum jacket and painted on both sides.

5. The Heat Pump shall utilize a 24VDC control circuit and components. The control system shall have a display for heat pump set-up, status and diagnostics. All components shall be easily accessed and serviceable,
6. The Heat Pump shall be equipped with low and high refrigerant pressure switches; short cycle control; outlet water temperature sensor and return water temperature.
7. The Heat Pump shall have an optional control for Cascade to sequence and rotate while maintaining operation up to six Heat Pumps of same Btu inputs. The Heat Pump shall have an optional gateway device which will allow integration with BACnet.
8. The Heat Pump shall be suitable for use with polypropylene glycol, up to 50% concentration.
9. Standard: UL 1453.
10. Storage-Tank Construction: ASME-code, steel vertical arrangement.
  - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
    - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
    - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
  - b. Pressure Rating: 150 psig.
  - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
11. Factory-Installed Storage-Tank Appurtenances:
  - a. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
  - b. Insulation: Comply with ASHRAE/IESNA 90.1.
  - c. Jacket: Steel with enameled finish.
  - d. Temperature Control: Adjustable thermostat.
  - e. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
  - f. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

## 2.2 DOMESTIC-WATER HEATER ACCESSORIES:

### A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

- a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- 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 calibrated memory-stop balancing valves to provide balanced flow through each domestic-water heater.
  - 1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23 –VALVES FOR PLUMBING PIPING,.
  - 2. Comply with requirements for balancing valves specified in Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
- E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.

- F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## 2.3 SOURCE QUALITY CONTROL:

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to 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. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 – QUALITY REQUIREMENTS for retesting and reinspecting requirements and Section 01 73 00 – EXECUTION for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION:

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 03 30 00 – CAST-IN-PLACE CONCRETE.
  - 1. Exception: Omit concrete bases for commercial, electric, 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 electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 – VALVES FOR PLUMBING PIPING.
- C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT.
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water



piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. 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 electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES.
- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- H. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23 – VALVES FOR PLUMBING PIPING, Section 22 05 23.13, and comply with requirements for thermometers specified in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill electric, domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

### 3.2 CONNECTIONS:

- A. Comply with requirements for piping specified in Section 22 11 16 – DOMESTIC WATER PIPING. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.3 IDENTIFICATION:

- A. Identify system components. Comply with requirements for identification specified in Section 22 00 50 – BASIC PLUMBING REQUIREMENTS.

### 3.4 FIELD QUALITY CONTROL:

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 – QUALITY REQUIREMENTS for retesting and reinspecting requirements and Section 01 73 00 – EXECUTION for requirements for correcting the Work.
- C. Prepare test and inspection reports.

### 3.5 DEMONSTRATION:

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION

## SECTION 22 42 00

### COMMERCIAL PLUMBING FIXTURES (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 RELATED DOCUMENTS

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

##### 1.3 SUMMARY

- A. Section Includes:
  - 1. Water closets.
  - 2. Water coset flushometer valves and tanks.
  - 3. Toilet seats.
  - 4. Urinals.

5. Urinal flushometer valves.
6. Lavatories.
7. Lavatory faucets.
8. Mop basins.
9. Service sinks.
10. Utility sinks.
11. Handwash sinks and wash fountains.
12. Kitchen sinks.
13. Sink faucets.
14. Individual shower receptors.
15. Shower faucets.
16. Shower basins.
17. Drinking fountains and bottle filling stations.
18. Supply fittings.
19. Waste fittings.
20. Supports.
21. Grout.

#### 1.4 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for plumbing fixtures.
  2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

## 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.
- B. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Division 01, include the following:
    - a. Servicing and adjustments of automatic faucets.
- C. Maintenance Data: For sinks to include in maintenance manuals.

## 1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
  - 2. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 3. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

## PART 2 - PRODUCTS

## 2.1 WALL-MOUNTED WATER CLOSETS

- 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. Kohler Co.
  - 3. Sloan Valve Company.
  - 4. TOTO USA, INC.
  - 5. Zurn Industries, LLC.
- B. Water Closets: Wall mounted, accessible.
  - 1. Bowl:
    - a. Standards: ASME A112.19.2 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Siphon jet.
    - d. Style: Flushometer valve.
    - e. Height: Standard.
    - f. Rim Contour: Elongated.
    - g. Water Consumption: 1.28 gal. per flush.
    - h. Spud Size and Location: NPS 1-1/2; top.
  - 2. Toilet Seat: Elongated rim, open front.
  - 3. Support: Water closet carrier.

4. Water-Closet Mounting Height: Standard or Handicapped/elderly according to ICC/ANSI A117.1, as indicated on Contract Drawings.

## 2.2 WATER CLOSET FLUSHOMETER 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. American Standard.
  2. Kohler Co.
  3. Sloan Valve Company.
  4. TOTO USA, INC.
  5. Zurn Industries, LLC.
  6. Or approved equal.
- B. Lever-Handle, Diaphragm Water Closet Flushometer Valves:
  1. Standard: ASSE 1037.
  2. Minimum Pressure Rating: 125 psig.
  3. Features: Include integral check stop and backflow-prevention device.
  4. Material: Brass body with corrosion-resistant components.
  5. Exposed Flushometer-Valve Finish: Chrome plated.
  6. Panel Finish: Chrome plated or stainless steel.
  7. Style: Exposed.
  8. Consumption: **1.28 gal.** per flush.

9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

## 2.3 TOILET SEATS

### A. Toilet Seats:

1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Commercial (Heavy duty).
4. Shape: Elongated rim, open front.
5. Hinge: Self-sustaining, check.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.



8. Color: White.

## 2.4 SUPPORTS

### A. Water Closet Carrier:

1. Standard: ASME A112.6.1M.

### B. 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.

## 2.5 WALL-HUNG URINALS

### 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. Kohler Co.
3. Sloan Valve Company.
4. TOTO USA, INC.
5. Or approved equal.

### B. Urinals: Wall hung, back outlet, accessible.

1. Fixture:
  - a. Standards: ASME A112.19.2 and ASME A112.19.5.
  - b. Material: Vitreous china.
  - c. Type: Siphon jet or Washout with extended shields.

- d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
  - e. Water Consumption: Water saving.
  - f. Spud Size and Location: NPS 3/4; top.
  - g. Outlet Size and Location: NPS 2; back.
  - h. Color: White.
- 2. Waste Fitting:
    - a. Standard: ASME A112.18.2 for coupling.
    - b. Size: NPS 2.
- 3. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
  - 4. Urinal Mounting Height: Standard or Handicapped/elderly according to ICC A117.1, as indicated on Contract Drawings.

## 2.6 URINAL FLUSHOMETER 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. American Standard.
  2. Kohler Co.
  3. Sloan Valve Company.
  4. TOTO USA, INC.
  5. Or approved equal.
- B. Lever-Handle, Diaphragm Urinal Flushometer Valves:
1. Standard: ASSE 1037.
  2. Minimum Pressure Rating: 125 psig.
  3. Features: Include integral check stop and backflow-prevention device.
  4. Material: Brass body with corrosion-resistant components.
  5. Exposed Flushometer-Valve Finish: Chrome plated.
  6. Panel Finish: Chrome plated or stainless steel.
  7. Style: Exposed.
  8. Consumption: **0.5 gal.** per flush.
  9. Minimum Inlet: NPS 3/4.
  10. Minimum Outlet: NPS 3/4.

## 2.7 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

- 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. Kohler Co.
  3. Sloan Valve Company.
  4. Or approved equal.

B. Lavatory Insert drawing designation: Oval, vitreous china, undercounter mounted.

1. Fixture:
  - a. Standard: ASME A112.19.2.
  - b. Type: For undercounter mounting.
  - c. Nominal Size: Oval, 19 by 16-inches.
  - d. Faucet-Hole Punching: No holes.
  - e. Faucet-Hole Location: On countertop.
  - f. Color: White.

## 2.8 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

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. Kohler Co.
3. Sloan Valve Company.
4. Or approved equal.

B. Lavatory: Vitreous china, wall mounted, with back.

1. Fixture:
  - a. Standard: ASME A112.19.2.
  - b. Type: For wall hanging.
  - c. Nominal Size: Oval, 21 by 18-inches.
  - d. Faucet-Hole Punching: One hole.

- e. Faucet-Hole Location: Top.
- f. Color: White.
- g. Mounting Material: Chair carrier.
- 2. Support: Type II, concealed-arm lavatory carrier with escutcheons.
- 3. Lavatory Mounting Height: Standard or Handicapped/elderly according to ICC A117.1, as indicated on the Contract Drawings.

## 2.9 LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. American Standard.
  - 2. Bradley Corporation.
  - 3. Chicago Faucets; Geberit Company.
  - 4. Kohler Co.
  - 5. Moen Incorporated.

6. Sloan Valve Company.
7. TOTO USA, INC.
8. Or approved equal.

C. Solid-Brass, Manually Operated Lavatory Faucets: Manual-type, [**single-control mixing**], solid-brass valve.

1. Standard: ASME A112.18.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
3. Body Type: **Centerset**.
4. Body Material: Commercial, solid brass.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 0.5 gpm.
7. Maximum Flow: 0.25 gal. per metering cycle.
8. Mounting Type: Deck, exposed.
9. Valve Handle(s): **Single lever**.
10. Spout: **Rigid** type.
11. Spout Outlet: Aerator.
12. Operation: Cartridge, manual.
13. Drain: Not part of faucet.

2.10 LAVATORIES SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1.

- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

## 2.11 LAVATORIES WASTE FITTINGS

- A. Standard: ASME A112.18.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## 2.12 MOP BASINS

- 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. Acorn Engineering Company; a Division of Morris Group International.
2. Fiat Products.
3. Florestone Products Co., Inc.
4. Stern-Williams Co., Inc.
5. Or approved equal.

B. Service Basins: Terrazzo, floor mounted.

1. Fixture:
  - a. Standard: IAPMO PS 99.
  - b. Shape: Square.
  - c. Nominal Size: 24 by 24-inches.
  - d. Height: 10-inches.
  - e. Tiling Flange: On two sides.
  - f. Rim Guard: On front top surfaces.
  - g. Color: Not applicable.
  - h. Drain: Grid with NPS 3 outlet.
2. Mounting: On floor and flush to wall.

## 2.13 SERVICE SINKS

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. Commercial Enameling Company.



3. Kohler Co.
4. Zurn Industries, LLC.
5. Or approved equal.

B. Service Sinks: Enameled, cast iron, trap standard mounted.

1. Fixture:
  - a. Standard: ASME A112.19.1.
  - b. Type: Service sink with back.
  - c. Back: Plain.
  - d. Nominal Size: 24 by 20-inches.
  - e. Color: White.
  - f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
  - g. Rim Guard: On front and sides.
2. Support: Type II sink carrier.
3. Lavatory Mounting Height: Standard.

2.14 UTILITY SINKS:

- 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. Eagle Group.
  - 3. Elkay.
  - 4. Griffin Products, Inc.
  - 5. Just Manufacturing.
  - 6. Or approved equal.
- B. Utility Sinks: Stainless steel, freestanding.
  - 1. Fixture:
    - a. Standard: ASME A112.19.3.
    - b. Type: With backsplash.
    - c. Number of Compartments: One.
    - d. Overall Dimensions: 27 by 27.5 inches by 43 inches high.
    - e. Metal Thickness: 0.050-inch.
    - f. Compartment:
      - 1) Dimensions: 24 by 24 inches, 12 inches depth.
      - 2) Drain: Grid with NPS 2 tailpiece and twist drain.
      - 3) Drain Location: Centered in compartment.
    - g. Drainboard(s): Not required side(s).
  - 2. Supports: Adjustable-length steel legs.

## 2.15 HANDWASH SINKS:

A. Handwash Sinks: Stainless steel, wall mounted.

1. Fixture:
  - a. Standards: ASME A112.19.3 and NSF/ANSI 2.
  - b. Type: Basin with radius corners, back for faucet, and support brackets.
  - c. Nominal Size: 17 by 16 by 5-inches.
2. Sink Mounting Height: Standard or Handicapped/elderly according to ICC A117.1, as indicated on the Contract Drawings.

B. Shop Sinks: Stainless steel, wall 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. Elkay, Model EFS2520, or approved equal.
2. Fixture:
  - a. Standards: ASME A112.19.3.
  - b. Type: Single bowl hand wash sink kit.
  - c. Materials: Type 304 stainless steel, with buffed satin finish, 14 gauge thick.
  - d. Nominal Size: 25 by 19.5 by 10.5-inches.
  - e. Drain: 3-1/2-inches, located rear-center.
3. Sink Mounting Height: Standard or Handicapped/elderly according to ICC A117.1, as indicated on the Contract Drawings.

C. Wash Fountains:

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. Bradley, model WF2703, or approved equal.
2. Standards: ASME A112.19.3
3. Type: Semi-circular bowl designed to accommodate up to three users.
4. Controls: The classic spray head is controlled by a foot rail. The operation range is from 20 to 80 psi. Flow rate controlled by volume control valve.
5. Bowl: Stainless steel, 14-gauge with polished finish.
6. Pedestal: Constructed of die-formed legs, upper braces, scuff bases and panels. Legs are zinc chromate plated 14-gauge steel. Upper braces are 16-gauge galvanized steel, and scuff bases and pedestal panels are 300 series stainless steel with polished finish.

7. Foot Activation: Each press of the foot rail mechanically actuates a hold-open valve with slow closing upon release of foot pressure.

## 2.16 KITCHEN SINKS:

### A. Sink: Stainless steel, Under-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. Just Manufacturing Company, Model SL-ADA,
  - b. Elkay,
  - c. Kohler,
  - d. Or approved equal.
2. Fixture:
  - a. Standards: ASME A112.19.3, ANSI A117.1.
  - b. Type: Single bowl with radius corners, self-rimming top mount, with ledge, ADA compliant.
  - c. Materials: Type 304 or 316 stainless steel, 16 or 18 gauges. Seamless die-drawn construction. Fully coated undersides for sound and reduces condensation.
  - d. Nominal Size: Refer to Contract Drawings.
  - e. Faucet Punching: One hole.
  - f. Drain: Integral drain system, 3.5-inches, with garbage disposal outlet.
  - g. Strainer: Crumb cup strainer with 1-1/2-inch offset tailpiece and stainless steel ground seat stopper.
  - h. Overflow: Not required.
  - i. Provide insulation kit on all roughing below sink.
3. Garbage Disposer, Continuous Feed (Provide if indicated on the Contract Drawings):
  - a. Provide garbage disposer as indicated on Contract Drawings.
  - b. Rugged galvanized steel construction, galvanized steel grinding elements with two stainless steel 360 degrees swivel lugs; space-saving compact design.
  - c. Motor: 1/2 horsepower, 120-volt, 1 phase, 60 hz, 1725 rpm, 6.9 amps, with manual reset overload.
  - d. Control: On/Off wall switch.
  - e. Drain: 1-1/2-inch cushioned slip joint.

## 2.17 SINK FAUCETS

- ### A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Standard.
2. Chicago Faucets; Geberit Company.
3. Delta Faucet Company.
4. Elkay.
5. Just Manufacturing.
6. Kohler Co.
7. Moen Incorporated.
8. Sloan Valve Company.
9. Or approved equal.

C. Sink Faucets: Manual type, single control mixing valve.

1. Commercial, Solid-Brass Faucets:
2. Standard: ASME A112.18.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Single hole.
5. Body Material: Commercial, solid brass.
6. Finish: Chrome plated.
7. Maximum Flow Rate: 2.2 gpm.
8. Handle(s): Lever.
9. Mounting Type: Deck, exposed.
10. Spout Type: Rigid gooseneck.
11. Vacuum Breaker: Not required for hose outlet.
12. Spout Outlet: Aerator.

## 2.18 SINK SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

## 2.19 SINK WASTE FITTINGS

- A. Standard: ASME A112.18.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 or NPS 2, as indicated on the drawings.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.

## 2.20 INDIVIDUAL SHOWERS

- A. Individual FRP Showers:

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. Aquarius Bathware; a Praxis Company.
  - b. Clarion Bathware.
  - c. Florestone Products Co., Inc.
  - d. LASCO Bathware.
  - e. MAAX.
  - f. Sterling.
  - g. Swan Corporation (The).
2. General: FRP, accessible, shower enclosure with faucet and receptor and appurtenances.
3. Standard: ANSI Z124.1.2.
4. Type: One-piece unit without top.
5. Style: Standard Handicapped/wheelchair where indicated.
6. Nominal Size and Shape: 36 by 36-inches square.
7. Color: White.
8. Bathing Surface: Slip resistant according to ASTM F462.
9. Outlet: Drain with NPS 2 outlet.
10. Shower Rod and Curtain: Required.
11. Grab Bar: ASTM F446, mounted on support area back wall, where indicated on the Contract Drawings.

B. Individual PMMA (Acrylic) Showers:

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. Acryline USA, Inc.
  - b. Aqua Bath Company, Inc.
  - c. Aquarius Bathware; a Praxis Company.
  - d. Aquatic Industries, Inc.
  - e. Clarion Bathware.
  - f. Crane Plumbing, LLC; a division of American Standard.
  - g. Jacuzzi Inc.
  - h. Kohler Co.

- i. LASCO Bathware.
  - j. MAAX.
2. General: PMMA shower enclosure with faucet and receptor and appurtenances.
  3. Standard: ANSI Z124.1.2.
  4. Type: One-piece unit without top.
  5. Style: Standard Handicapped/wheelchair where indicated.
  6. Nominal Size and Shape: 36 by 36-inches square.
  7. Color: White.
  8. Bathing Surface: Slip resistant according to ASTM F462.
  9. Outlet: Drain with NPS 2 outlet.
  10. Shower Rod and Curtain: Required.
  11. Grab Bar: ASTM F446, mounted on support area back wall, where indicated on the Contract Drawings.

## 2.21 SHOWER FAUCETS

- A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. American Standard.
  2. Chicago Faucets; Geberit Company.
  3. Kohler Co.
  4. Leonard Valve Company.
  5. Moen Incorporated.
  6. POWERS; A WATTS Brand.



7. Sloan Valve Company.
8. Zurn Industries, LLC.
9. Or approved equal

C. Shower Faucets:

1. Description: Single-handle, thermostatic mixing valve with hot- and cold-water indicators; check stops; and shower head.
2. Faucet:
  - a. Standards: ASME A112.18.1 and ASSE 1016.
  - b. Body Material: Solid brass.
  - c. Finish: Polished chrome plate.
  - d. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
  - e. EPA WaterSense: Required.
  - f. Mounting: Exposed.
  - g. Operation: Single-handle, push-pull or twist or rotate control.
  - h. Antiscald Device: Integral with mixing valve.
  - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
3. Supply Connections: NPS 1/2.
4. Shower Head:
  - a. Standard: ASME A112.18.1.
  - b. Type: Ball joint with arm and flange.
  - c. Shower Head Material: Metallic with chrome-plated finish.
  - d. Spray Pattern: Adjustable.
  - e. Integral Volume Control: Required.
  - f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
  - g. Temperature Indicator: Integral with faucet.

## 2.22 DRINKING FOUNTAINS, BOTTLE FILLING STATIONS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products the following:
  - 1. Elkay.
  - 2. Filtrine Manufacturing Company.
  - 3. Halsey Taylor.
  - 4. Haws Corporation.
  - 5. Oasis International.
  - 6. Or approved equal.
- B. Drinking Fountains and Bottle Filling Station, Refrigerated, Stainless steel, wheelchair accessible, wall mounted.
  - 1. Standards:
    - a. Comply with ASME A112.19.3.
    - b. Comply with NSF 61 and NSF 372.
    - c. Comply with ICC A117.1.
  - 2. Type Receptor: With back
  - 3. Receptor Shape: Round.
  - 4. Back Panel: Stainless-steel wall plate behind drinking fountain.
  - 5. Bubblers: Two, with adjustable stream regulator, located on deck.
  - 6. Maximum Water Flow: 0.15 gpm.
  - 7. Control: Push button.
  - 8. Drain: Grid type with NPS 1-1/4 tailpiece.

9. Supply: NPS 3/8 with shutoff valve.
  10. Waste Fitting: ASME A112.18.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
  11. Support: Water cooler carrier.
  12. Drinking Fountain Mounting Height: Handicapped/elderly according to ICC A117.1.
- C. Bottle-Filling Station: Recessed, wheelchair accessible.
1. Standards:
    - a. Comply with ASME A112.19.3.
    - b. Comply with NSF 61 and NSF 372.
    - c. Comply with ICC A117.1.
  2. Cabinet: All stainless steel.
  3. Finish Color: .
  4. Bottle Filler: Push-button activation, with automatic shut-off timer.
  5. Drain: Grid type with NPS 1-1/4 tailpiece.
  6. Supply: NPS 3/8 with shutoff valve.
  7. Waste Fitting: ASME A112.18.2, NPS 1-1/4 brass P-trap.
  8. Support: Water cooler carrier.
  9. Bottle-Filling Station Mounting Height: Handicapped/elderly according to ICC A117.1 or as indicated by the Architect.

## 2.23 SUPPORTS

### A. Water Closet Carrier:

1. Standard: ASME A112.6.1M.
2. 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.

### B. Urinal Carrier:

1. Type I, Standard: ASME A112.6.1M.

### C. Lavatory Carrier:

1. Type II Lavatory carrier, Standard: ASME A112.6.1M.
2. Type III, Standard Lavatory carrier: ASME A112.6.1M.

### D. Sink Supports:

1. Type II Sink Carrier, Standard: ASME A112.6.1M.

### E. Drinking Fountains and Pressure Water Coolers Supports:

1. Type I Water Cooler Carrier: Standard: ASME A112.6.1M.
2. Type II Water Cooler Carrier: Standard: ASME A112.6.1M.

## 2.24 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine walls and floors for suitable conditions where plumbing fixture will be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

### A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
4. Install toilet seats on water closets.
5. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
6. Match sealant color to water-closet color.
7. Comply with sealant requirements specified in Division 07.

### B. Water Closet Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

### C. Urinal Installation:

1. Install urinals level and plumb according to 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 for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.
6. Seal joints between urinal and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
7. Match sealant color to urinal color.
8. Comply with sealant requirements specified in Division 07.

### D. Urinal Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

E. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet and urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets and urinals with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

F. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 00 50."

G. Lavatories Installation:

1. Install lavatories level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
4. 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 22 00 50.
5. 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 Division 07.
6. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

H. Sinks Installation:

1. Install sinks level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-hung sinks.

3. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI 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.
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 22 00 50."Escutcheons for Plumbing Piping."
7. Seal joints between sinks and 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 Division 07.
8. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

I. Showers Installation:

1. Assemble shower components according to manufacturers' written instructions.
2. Install showers level and plumb according to roughing-in drawings.
3. Install water-supply piping with stop on each supply to each shower faucet.
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 escutcheons requirements specified in Section 22 00 50.
7. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.

J. Drinking Fountains and Pressure Water Coolers Installation:

1. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
2. Set pedestal and freestanding fixtures on floor.
3. Install recessed units secured to wood blocking in wall construction.
4. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
5. 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 22 05 23 "Valves for Plumbing Piping".
6. Install trap and waste piping on drain outlet of each fixture 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 where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

8. 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 Division 07.

### 3.3 CONNECTIONS

- A. Connect water closets and urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Connect lavatories, sinks, showers, and drinking fountains with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- E. Where installing piping adjacent to water closets, allow space for service and maintenance.

### 3.4 ADJUSTING

- A. Operate and adjust fixtures with their controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at flushometer valves and faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Adjust fixture flow regulators for proper flow and stream height.
- E. Adjust pressure water-cooler temperature settings.

### 3.5 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes. Remove paint splatters and other spots, dirt, and debris.



- B. Clean plumbing fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- C. Install protective covering for installed fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

## SECTION 22 45 00

### EMERGENCY PLUMBING FIXTURES (FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

#### PART 1 - GENERAL

##### 1.1 GENERAL PROVISIONS:

- A. Sub-Bid Requirements: As provided under Section 22 00 01 - PLUMBING SUB-BID REQUIREMENTS, and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 – GENERAL REQUIREMENTS.
- B. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

##### 1.2 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. Related Sections:
  - Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING
  - Section 22 05 23 – VALVES FOR PLUMBING PIPING
  - Section 22 11 16 – DOMESTIC WATER PIPING
  - Section 22 13 16 – SANITARY WASTE AND VENT PIPING

##### 1.3 SUMMARY:

- A. Section Includes:
  - 1. Combination units.
  - 2. Water-tempering equipment.

##### 1.4 DEFINITIONS:

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
- D. Tepid: Moderately warm.

1.5 ACTION SUBMITTALS:

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS:

- A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
- B. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS:

- A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.8 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. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

## PART 2 - PRODUCTS

### 2.1 COMBINATION UNITS:

#### A. Accessible, Plumbed Emergency Shower with Eye/Face Wash Combination Units:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Guardian Equipment Co.
  - b. Haws Corporation.
  - c. Speakman Company.
2. Piping:
  - a. Material: Galvanized steel.
  - b. Unit Supply: NPS 1-1/4 minimum.
  - c. Unit Drain: Outlet at back or side near bottom.
3. Shower:
  - a. Capacity: Not less than 20 gpm for at least 15 minutes.
  - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
  - c. Control-Valve Actuator: Pull rod.
  - d. Shower Head: 8-inch-minimum diameter, chrome-plated brass or stainless steel.
  - e. Mounting: Pedestal.
4. Eye/Face Wash Unit:
  - a. Capacity: Not less than 3 gpm for at least 15 minutes.
  - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
  - c. Control-Valve Actuator: Paddle.
  - d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
  - e. Receptor: Chrome-plated brass or stainless-steel bowl.
  - f. Mounting: Attached to shower pedestal.

#### B. Electric Alarm Unit with Safety Station:

1. Flow Switch: 1-1/4-inch IPS double pole, double throw waterproof flow switch for installation in water supply line to emergency unit. When unit is activated, light and horn activate, and electrical signal is sent to remote monitoring station. Switch shall sense flow of water when either the eyewash or shower is activated. Direction of flow shall be marked on switch body.
2. Visual Signal: Weatherproof amber beacon light with shatter-resistant lens and protective metal grid.

3. Audible Signal: Weatherproof horn delivers distinctive, urgent signal. Volume shall be present at 100 Db at 10 ft. Adjustment screw on front of horn shall allow adjustment of output sound level.
4. Mounting: Brackets for mounting on vertical pipe or wall, junction box and 5-foot flexible cord and receptacle.
5. Electrical Supply: 120 Volt, 0.8 Amp.
6. Quality Assurance: Unit shall be fully assembled, wired and factory tested prior to shipment.

## 2.2 WATER-TEMPERING EQUIPMENT:

### A. Hot- and Cold-Water, Water-Tempering 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. Acorn Safety; a Division of Morris Group International.
  - b. Armstrong International, Inc.
  - c. Guardian Equipment Co.
  - d. Lawler Manufacturing Company, Inc.
  - e. Stingray Systems LLC.
  - f. WATTS; A Watts Water Technologies Company.
2. Description: Factory-fabricated equipment with thermostatic mixing valve.
  - a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
  - b. Supply Connections: For hot and cold water.
  - c. Enclosure: Exposed stainless-steel cabinet with hinged door and cylinder lock.

## 2.3 SOURCE QUALITY CONTROL:

- ### A.
- Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

## PART 3 - EXECUTION

### 3.1 EXAMINATION:

- A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION:

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23 – VALVES FOR PLUMBING PIPING.
  - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
  - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16 – DOMESTIC WATER PIPING.
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING.
- G. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 22 13 16 – SANITARY WASTE AND VENT PIPING.
- H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 00 50.

### 3.3 CONNECTIONS:

- A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 22 11 16 – DOMESTIC WATER PIPING
- B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 11 16 – DOMESTIC WATER PIPING
- C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- D. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

### 3.4 IDENTIFICATION:

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 00 50.

### 3.5 FIELD QUALITY CONTROL:

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.6 ADJUSTING:

- A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION