

**SECTION 220000**  
**GENERAL REQUIREMENTS FOR PLUMBING TRADES**

**PART 1 - GENERAL**

**1.1 STIPULATIONS**

- A. The Specifications Sections "General Conditions of Contract", "Special Conditions" and "Division 1 – General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

**1.2 SINGULAR NUMBER**

- A. In all cases where a device or part of an equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation. Quantity determinations of all materials and equipment shall be the complete responsibility of the Contractor.

**1.3 DEFINITIONS**

- A. The following are definitions of terms and expressions used throughout Division 22 specifications:
1. Client Agency - Rockland Green MRF Facility
  2. Professional - Anderson Design Group
  3. Provide - Furnish and install.
  4. Work - Plant, labor and material.
  5. Directed - Directed by the PROFESSIONAL.
  6. Indicated - Indicated by the contract documents
  7. Concealed - Hidden from sight; includes items in shafts, pipe and duct spaces, and above ceilings.
  8. Exposed - Not concealed; work within equipment rooms and exposed to view by the occupant shall be considered exposed.
  9. Piping - Includes pipes, fittings, valves, hangers, and accessories comprising a System.
  10. Ductwork - Includes ducts, fittings, housings, plenums, dampers, hangers, and accessories comprising a system.
  11. BMCS - Building Management and Control System.
  12. HVAC - Heating, Ventilating, and Air-conditioning.

**1.4 SCOPE OF WORK**

- A. This Section includes general administrative procedures and requirements for mechanical installations, as well as basic materials and methods of construction for the installation of mechanical systems.
- B. The following administrative procedures and requirements are included in this section to expand and supplement the requirements specified in the front end of this specification:
1. Work Included
  2. Work Excluded
  3. Contract Drawings
  4. Coordination Drawings
  5. Record Drawings
  6. Codes, Permits, Approvals
  7. Inspections

8. Materials and Equipment
  9. Source of Supply List
  10. Submittals/Shop Drawings
  11. Contractor's Responsibilities - Submittals
  12. Substitution of Materials and Equipment
  13. Service Agencies
  14. Performance of Equipment
  15. Guaranty/Warranty
  16. Operating and Maintenance Manuals
  17. Charts
- C. The following basic materials and methods of construction for the installation of mechanical systems are included in this section:
1. Sleeves
  2. Fire stopping
  3. Finish Plates
  4. Equipment foundations
  5. Anchor Bolts
  6. Concrete Anchors
  7. Vibration Control
  8. Accessibility
  9. Examination of site
  10. Dimension of Existing Structures
  11. Lines, Grades, and Measurements
  12. Coordination
  13. Delivery, Storage, and Handling
  14. Protection
  15. Excavation and Backfilling
  16. Cutting and Patching
  17. Equipment installation and connection
  18. Firestopping Inspection
  19. Roof Work
  20. Flashing
  21. Rooftop Equipment Supports
  22. Painting
  23. Pipeline Identification
  24. Mounting Mechanical Devices in Suspended Ceilings
  25. Electrical Work
  26. Coordination of Responsibilities.

## **1.5 WORK INCLUDED**

- A. Work under Division 22 of the specifications of the contract shall include all plant, labor, and material required to complete the work as shown on the drawings, hereinafter specified, or both. Work of this contract shall include but not be limited to the items outlined in each of the Division 22 sections herein. Work generally includes:
  - 1. Natural gas piping, valves, hangers, roof supports, etc. connected to new equipment.
  - 2. Internal sanitary drainage and vent systems.
  - 3. Complete water distribution system to all fixtures and equipment.
  - 4. Natural gas-fired water heaters and hot water recirculation pumps.
  - 5. All plumbing fixtures, faucets, valves, etc. as listed.
  - 6. Miscellaneous general construction as noted.
  - 7. Thermal insulation as required.
  - 8. Testing and adjustment of all work installed.
- B. These specifications, in conjunction with the working drawings, are intended to provide finished work, and all items called for by either or both shall be considered as part of the job. Any items omitted from the specifications or drawings that are clearly necessary for the completion of the work shall be included in the Contract, unless specifically mentioned otherwise.

## **1.6 WORK EXCLUDED**

- A. All work shown or specified shall be included in the Contract unless specifically mentioned herein.

## **1.7 INTENT OF DRAWINGS**

- A. Work indicated on the drawings shall be provided by the Contractor generally responsible for the work related to any particular drawing, i.e.:
  - 1. H-# drawings - Mechanical/HVAC Contractor
  - 2. P-# drawings - Plumbing Contractor
- B. Work may include items that may relate to other major trades. Specifically, all work indicated on the "P" drawings (Plumbing) shall be provided by the Plumbing Contractor unless specifically indicated to be provided by others. The same principle shall apply to "M" drawings (Mechanical), etc.

## **1.8 CONTRACT DRAWINGS**

- A. Drawings that constitute a part of this contract indicate the general arrangement of piping, ductwork, accessories, equipment, and other work. It is the intent of these drawings and specifications to describe a complete and integrated system. It is understood that while the drawings may not show every pipe, valve, damper and detail, all equipment and accessories which are reasonably inferable from the drawings and specifications as being necessary for the completion and proper performance of the work shall be included even though not specifically mentioned. What is called for on either the drawings or in the specifications shall be as binding as if called for on both.
- B. It is understood that while the drawings shall be followed as closely as circumstances will permit, the Contractor is held responsible for the proper installation of materials and equipment to the true intent and meaning of plans and specifications. Should it be found that any equipment, piping, ductwork cannot be installed as shown on the drawings, the Contractor shall consult with the Professional before making any changes.

## **1.9 COORDINATION DRAWINGS**

- A. The contractor shall prepare coordination drawings for Mechanical equipment rooms, chases, congested areas above ceilings, and other congested areas.

- B. Coordination drawings shall be prepared to a scale of 1/4"=1'-0" or larger, detailing major elements, components, and systems of mechanical equipment and materials in relationship to other systems, installations and building components.
- C. Coordination drawings shall:
  - 1. Indicate the proposed locations of any piping, ductwork, equipment and materials relating to the following:
    - a. Exterior wall and foundation penetrations
    - b. Equipment pads and bases
    - c. Clearances for installing, servicing and maintaining equipment, including tube removal, filter removal and space for equipment disassembly required for periodic maintenance.
    - d. Equipment service connections and support details.
    - e. Ceiling plenums, chases, shafts, trenches, and other tight and congested spaces
    - f. Duct system layout, include elbows, radii, and accessories.
  - 2. Indicate the proposed scheduling, sequencing, movement and positioning of large equipment into the building during construction.
  - 3. Include floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
  - 4. Include reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

#### **1.10 RECORD DRAWINGS**

- A. At final inspection, the Contractor shall prepare and deliver to the Professional a complete set of contract prints in PDF format, corrected with suitable markings to show all changes or variations from the original contract showing details of the work as actually built including but not limited to horizontal and vertical dimensions of all concealed pipe and equipment.

#### **1.11 CODES, PERMITS, APPROVALS**

- A. All required local, state and utility company permits and approvals shall be applied for and paid for by this Contractor.
- B. All persons digging at the site shall notify the responsible New York agency to mark all underground utilities prior to digging.
- C. All plumbing, fire protection, and mechanical/HVAC work under this contract shall be subject to all provisions of the latest editions - including supplements - of the New York State Building Code, the New York State Plumbing Code, the International Plumbing Code, the International Building Code, and the International Fire Code, including NFPA-90a and 90b. Plumbing system shall comply with all municipal, state, and local codes having jurisdiction.
- D. All work shall meet the requirements and standards of the several Utility Company(s) serving the project. Install and test backflow preventers in accordance with regulations of the serving utility company.
- E. All heating work, pressure vessels, etc. shall comply with the latest revision of the regulations of the Commonwealth of Pennsylvania, Department of Labor and Industry.
- F. All materials furnished shall meet the ASTM Specifications latest revisions.
- H. All electrical work shall be in conformance with the latest edition of the National Electrical Code.
- I. All sprinkler work shall be subject to all applicable provisions of the International Building Code (latest edition) and the National Fire Code pamphlet NFPA-13.

### **1.12 INSPECTIONS**

- A. All plumbing work shall be inspected by a certified Inspection Agency to guarantee conformance to the New York State Building Code and the International Plumbing Code requirements.
- B. Upon completion of the plumbing work, this Contractor shall pay for and deliver to the Professional, two (2) copies of the Agency's Certificate of Final Approval. This inspection shall cover only the work performed under this contract.

### **1.13 MATERIALS AND EQUIPMENT**

- A. Equipment and materials specified shall, in all cases, be the quality standard for base bidding.
- B. See General Conditions.
- C. The contractor understands that:
  - 1. the Professional will use their own judgment in determining whether or not any materials, equipment or methods offered for review as an equivalent are equivalent to those specified and will fit the space available;
  - 2. the decision of the Professional on all such questions of equivalency is final;
  - 3. any acceptable material, equipment and methods will be provided at no increases in cost to the Institution.

### **1.14 SOURCE OF SUPPLY LIST**

- A. Within 21 days after award of contract, the contractor shall submit to the Professional for review a list of manufacturer's names of material and equipment he proposes to provide. In the event any item of material or equipment contained in the list fails to comply with the specification requirements, such item will be rejected. If, prior to the expiration of the 21-day period, or any duly authorized extension thereof, the Contractor fails to submit a schedule of acceptable material or equipment, the Professional will select the items; such selection shall be final and binding upon the Contractor as condition of the contract. Rejected items shall be resubmitted within 21 days or the Professional will select such materials and equipment.

### **1.15 SUBMITTALS AND SHOP DRAWINGS**

- A. After receiving approval of the source of supply list; furnish catalog data, dimensional data, performance specifications, etc., in sufficient detail to properly identify and judge each item. Each item or equipment proposed shall be a standard product of the approved manufacturer.
- B. Samples, drawings, specifications, catalogs, etc., submitted for review shall be dated, properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, Contractor's name, and name of job.
- C. Review of shop drawings or samples by the Professional shall not relieve the Contractor of responsibility for any deviation from the requirements of the contract documents. Deviations from the contract documents will be only be allowed if all the following are satisfied:
  - 1. The Contractor has informed the Professional in writing of all deviations at the time of submission,
  - 2. the contractor has noted the deviation on the shop drawings,
  - 3. The Professional has acknowledged, in writing, the specific deviation.
- D. In any event, the Professional's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.
- E. No materials or equipment shall be purchased, delivered to the site, or installed until they have been reviewed by the Professional. Review of any submittal shall not relieve the Contractor of responsibility for deviation from the drawings or specifications, nor shall it relieve the Contractor from errors in the submittals. Dimensions and quantities shall, in all cases, be the complete responsibility of the Contractor.

- F. Subsequent to the Professional's review of a submittal, it shall be marked with one or more comments as defined below:
  - 1. No Exceptions Taken: The contractor may proceed using the reviewed material,
  - 2. Note Markings: The contractor may proceed using the reviewed material provided corrective action is taken on all comments noted on the submittal,
  - 3. Comments Attached: Same as "Note Markings", except that comments have been noted on a supplemental attachment,
  - 4. Contractor Confirm: The contractor shall respond in writing to all comments including confirmation that corrective action will be taken on all comments noted prior to proceeding with the work,
  - 5. Resubmit: The contractor shall respond to all comments noted, revise shop drawings accordingly, and resubmit for review,
  - 6. Rejected: The proposed material or equipment does not comply with the requirements of the contract documents and may not be used for this project.
- G. Upon receipt of written notice from the Professional that the material, equipment or methods have been reviewed and marked either "no exceptions taken", "Note Markings", or "Comments Attached", the Contractor may proceed with the reviewed material, equipment or methods. The Contractor assumes full responsibility for and shall make, at no expense to the Institution, all changes or adjustments in construction that may result by the use of such approved materials, equipment or methods, including electrical and other services provided under other divisions of this specification. In the event of any adverse decisions by the Professional, no claim of any sort shall be made or allowed against the Professional or the Institution.
- H. If material or equipment is installed prior to receipt by the contractor of submittals marked "no exceptions taken", "note markings", or "comments attached", the Contractor shall be liable for its removal and replacement at no extra cost to the Institution.
- I. Sufficient sets shall be submitted to allow two 2 copies to be retained by the Professional.
- J. Materials and equipment requiring submittals are listed in each section of these specifications.
- K. See also the General Conditions, paragraph 63.42 "Shop Drawings and Samples".

#### **1.16 CONTRACTORS RESPONSIBILITY - SUBMITTALS**

- A. Each submittal forwarded to the Professional/Professional's office for review shall be accompanied by a letter certifying that the Contractor has personally reviewed the material submitted and found it to be satisfactory for this project. This certification shall cover dimensional checking as well as cross checking with the Architectural, Mechanical and/or Electrical documents to insure that no changes will be required in other contracts.
- B. Any material submitted to the Professional's office without this Contractor's certification will be returned without action.
- C. Whenever alternate equipment is submitted, it shall be accompanied by a 1/4" - 1'0" scale drawing of the mechanical equipment room showing the alternate equipment, all clearances, etc. Submittals without this information will be returned without review or comment.

#### **1.17 SUBSTITUTION OF EQUIPMENT**

- A. Substitution of equipment of makes other than those specified, after receipt of the bid, will be approved by the Professional only if:
  - 1. The equipment proposed for substitution is equivalent or superior to equipment named in terms of construction, efficiency, and utility, and
  - 2. That the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other Contractors, due to conditions beyond control of the Contractor.

- B. To receive consideration, requests for substitutions must be accompanied by documentary proof of equivalence or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.
- C. In case of a difference in price, the Institution shall receive all benefit of the difference in cost involved in any substitution, and the contract altered by change order to credit Institution with any savings so obtained.

#### **1.18 SERVICE AGENCIES**

- A. All mechanical equipment suppliers shall have an established authorized service agency located within a 50-mile radius of the project area. Within 15 days after award of the contract, submit to the Professional for review along with the list of material and equipment manufacturer's names, a list of prospective service agencies to be used during the guarantee period. In the event any service agency in the list fails to comply with the specification requirements, such service agency will be rejected.

#### **1.19 PERFORMANCE OF EQUIPMENT**

- A. All materials, equipment and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the work in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance and capacity. No approval either written or verbal of any drawings, descriptive data or samples of such material, equipment and/or appurtenances shall relieve the Mechanical Contractor of his responsibility to turn over the same to the Institution in perfect working order at the completion of the work.
- B. If the operation, capacity, or performance of any material, equipment, or appurtenance, does not comply with the drawings and/or specification requirements, or is damaged prior to acceptance by the Institution, respective item(s) will be considered defective. All defective items shall be removed and replaced with proper and acceptable materials, equipment and/or appurtenances, or, put in proper and acceptable working order, satisfactory to the Professional, prior to final payment without additional cost to the Institution.

#### **1.20 GUARANTY/WARRANTY**

- A. Materials, equipment, and systems furnished under these specifications shall be guaranteed against defects in material, design, and workmanship.
- B. The guarantee period shall extend until the later of:
  - 1. A period of one (1) year from the date of final acceptance,
  - 2. Eighteen (18) months from the date of initial start-up.
- C. Any material or equipment comprising a part of any system, which shall develop any defect during the guarantee period shall be replaced by the Contractor at their own expense.
- D. Contractor shall turn over to the Institution all warranties and guarantees upon completion and final acceptance of project.

#### **1.21 OPERATING AND MAINTENANCE MANUALS**

- A. Contractor shall submit operating and maintenance instructions for all equipment furnished by them.
- B. Maintenance and operating instructions shall be manuals prepared by the various manufacturers for the specific equipment furnished. Manuals shall cover such items as start-up procedures, trouble-shooting, periodic maintenance, etc. Advertising literature or catalogs will not be acceptable in this connection.
- C. Three (3) sets of the above material shall be submitted to the Professional for review and approval.
- D. Final job acceptance date shall be the date stamped on the operating and maintenance instructions and the guarantee period shall generally extend from that date.

## 1.22 CHARTS

- A. Provide permanent type charts, framed under glass, mounted where directed as follows:
  - 1. Valve charts giving valve use, system and number on tag attached to valve.
  - 2. Equipment and motor list giving system, equipment designation and motor horsepower.
  - 3. Lubrication instructions for all equipment giving type of lubricant and frequency.
  - 4. Service organizations with normal and emergency telephone numbers.
  - 5. Abbreviated operating instructions for all mechanical systems.

## PART 2 - PRODUCTS

### 2.1 SLEEVES

- A. Pipes passing through masonry construction shall be fitted with sleeves. Each sleeve shall extend through its respective floor, wall, or partition and shall be cut flush with each surface unless otherwise required. Except where otherwise specified or shown, sleeves shall be two pipe sizes larger than the pipe when uncovered and of sufficient size to allow for the insulation without binding. Sleeves shall be properly installed and securely cemented in place.
- B. Sleeves in bearing and masonry walls, floors, and partitions shall be of standard weight steel pipe finished with smooth edges. For other than masonry partitions, through suspended ceiling, and for concealed vertical piping, sleeves shall be No. 22 USS Gauge galvanized iron.
- C. Floor sleeves shall extend 1 inch above finished floor in pipe spaces, waterproofed floors, kitchens and toilet rooms. Any additional reinforcing necessary to be used at location of sleeve shall be furnished by the Plumbing Contractor.
- D. Where pipes pass through waterproof floor or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.
- E. Where pipes pass through roofs, sleeves will be flashed and made watertight by the General Contractor unless otherwise specified or shown on the drawings. Counter flashing fittings shall be furnished and installed on all vents by this Contractor.
- F. Sleeves through exterior walls below grade shall have the space between pipes and sleeve caulked watertight with oakum and lead caulked tight; above grade shall be caulked with an approved caulking compound.

### 2.2 FIRE STOPPING

- A. Provide firestopping for all mechanical penetrations through floor slabs, fire-rated walls and partitions, and at each floor level in vertical service shafts used for mechanical services, as specified herein and approved by the Professional.
- B. Sealant: Provide ready-to-use silicone penetration seal that will stop passage of fire, smoke, and water through fire-rated wall and floor penetrations. Sealant provided must cure in the presence of atmospheric moisture to produce durable and flexible seal, and form airtight and watertight bonds with most common building materials in any combination including cement, masonry, steel, and aluminum.
- C. UL Classification: Provide firestopping materials that are currently classified with UL as "Fill, Void, or Cavity Materials", and "Through Penetration Firestop Systems".
- D. Fire Tests: Provide firestopping materials that have been tested in accordance with ASTM E-814 "Methods for Fire Tests of Through-Penetration Fire Stops" and UL 1479 "Fire Tests of Through-Penetration Firestops".
- E. Submittals: Submit manufacturer's technical product data, including product description, technical data, and installation instructions.
- F. If sleeves are employed, the average clearance between sleeve and piping shall not exceed one inch (1").

- G. Metal Pipe:
  - 1. Support sealant with three-inch (3") thickness of mineral wool, inserted and compressed into opening.
  - 2. Apply sealant bead to depth of one-half inch (1/2") by pushing bead in front of nozzle to fill void above mineral wool support.
  - 3. Tool sealant immediately after application and before skin forms. Protect seal from any disturbance for 48 hours minimum.
- H. Plastic (PVC) Pipe:
  - 1. Support sealant with nominal two inch (2") intumescent pipe wrap. Wrap pipe one time less than the pipe size with a minimum of 2 wraps.
  - 2. Apply sealant bead to a depth of one-half inch (1/2") by pushing bead in front of nozzle to fill void above intumescent wrap.
  - 3. Tool sealant immediately after application and before skin forms. Protect seal from any disturbance for 48 hours minimum.
- I. Where unusual openings are required because of size, shape of wall or floor construction, the fire stop application and material used shall be referred to the Professional/Professional for review and approval.
- J. Pipe insulation shall not pass through sleeves in fire-rated walls and floors. Only fire stopping materials shall be used in these areas.
- K. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

### **2.3 FINISH PLATES**

- A. At the end of each pipe sleeve where pipes pass into a finished space or through a suspended ceiling, provide chromium plated finish plates. Wall and ceiling plates shall be preferably one piece, held to the pipe by roundhead set screws or fastened to the building construction.
- B. Spring clips on wall and ceiling plates will not be acceptable.
- C. Where necessary to cover beads of fittings, special deep escutcheons shall be provided. Where pipe sleeves extend above a finished floor, a floor plate having a deep recess shall be used.
- D. Finish plates shall be of cast construction with polished finish.

### **2.4 ANCHOR BOLTS**

- A. Provide and set in place, at the time of pouring concrete foundations, all necessary concrete anchors as required for the equipment called for under these specifications.
- B. Anchor bolts shall be hook-type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one-half the embedded length of the bolt.
- C. Plumbing Contractor shall have full responsibility for proper placement of the bolts/anchors and must have a representative present at the time foundations are poured.
- D. After the equipment is set in its proper position, the half sleeves and the space between the base of the equipment and the foundation shall be completely filled with a thin cement grout.

### **2.5 CONCRETE ANCHORS**

- A. Concrete anchors shall be adjustable type consisting of a cast malleable iron body, hook type anchor bolt, and removable mounting stud. Mounting stud shall be adjustable to compensate for inaccuracies in setting.

## **2.6 VIBRATION CONTROL**

- A. Vibration isolation devices shall be provided in accordance with Chapter 46, Table 45, "Selection Guide for Vibration Isolation", of the American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.'s (ASHRAE) 1999 Application Handbook.

## **2.7 ACCESSIBILITY**

- A. Locate all equipment that must be serviced, operated, or maintained, in fully accessible positions. Equipment shall include, but not be limited to, VAV terminal units, coils, valves, motors, controllers, dampers, drain points, traps, strainers, etc. The contractor shall rework, at their expense, any equipment that is deemed inaccessible to the satisfaction of the Professional.
- B. Where required or directed by the Professional, provide access panels for access to all equipment where no other means of access is available. All access panels shall be of sufficient size to service and remove the equipment for which they are provided, and in no case shall they have a clear opening less than 8" x 8". Access panels shall be set flush with finished surface and shall be held securely in place by means of integral anchoring lugs.
- C. In finished walls they shall be smooth, polished nickel bronze access covers and full 8" x 8" openings.
- D. Those in floors shall be square nickel bronze non-slip scoriated access covers as conditions require.
- E. Access panels in fire rated walls, floors, shafts and partitions shall be labeled as such and shall match the rating of the adjacent construction.
- F. Access panels in kitchen areas and toilet rooms shall be stainless steel or have chrome plated finish.
- G. Access panels larger than 12" x 12" shall be of steel construction, having frames designed to suit the various locations and materials to which they are attached. The frames shall be rabbeted to receive cover and set flush with finished wall or ceiling surface. Covers shall be of rustproof furniture steel of not less than #14 gauge, and shall be secured with suitable clips and locking cams or countersunk screws. Covers shall be flush with the frames and finished wall or ceiling surface.
- H. Where accessible or removable ceilings are provided, ceiling panels or tiles may be removed to serve as access panels.
- I. In general, access panels will not be indicated on the drawings. It shall be the Contractor's responsibility to anticipate these needs and to provide access panels as previously specified.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION OF SITE**

- A. Contractor shall familiarize themselves with all drawings and documents for the entire project.
- B. By virtue of submitting a proposal, Contractor accepts the fact that tight conditions will likely occur at various locations. No extras will be approved for necessary variations and/or adjustments that may be required to resolve interferences.
- C. Details of proposed changes found necessary by field conditions or other causes shall be submitted to the Professional for approval before proceeding with any such change.
- D. No extra compensation will be allowed due to a difference between actual dimensions and measurements at the site and those indicated on the drawings.

### **3.3 LINES, GRADES, AND MEASUREMENTS**

- A. Make all measurements and check all dimensions necessary for the proper construction of the work called for by the drawings and specifications. During the prosecution of the work, make all necessary measurements to prevent misfitting in said work, and for the accurate construction of the entire work.

### **3.4 COORDINATION**

- A. Plumbing Contractor shall plan all phases of their portion of the project so that the work proceeds with a minimum of interference with other trades. They shall cooperate with all other Contractors in coordinating the location of piping, ducts, etc., with lighting fixtures, structural members, etc.
- B. Plumbing Contractor shall check all project drawings prior to installing any equipment, pipes, ducts, etc. Any conflicts that become apparent as a result of cross checking drawings shall be resolved with the Professional prior to any work being done. Minor adjustments in location, size, and type of materials necessary to work out any interference shall be made at no extra cost. Being installed "first" in any particular situation will not be considered a factor in the proper resolution of a conflict.

### **3.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification; adequately packaged and protected to prevent damage during shipment, storage, and handing.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. If any materials or equipment are found to be damaged or in poor condition at the time installation, the Professional may, at their discretion, order the Contractor to furnish and install new materials or equipment at no additional expense to the Institution.

### **3.6 PROTECTION**

- A. All work, equipment and materials shall be protected at all times. All pipe openings shall be capped and plugged during installation.
- B. The Contractor shall adequately cover and protect all plumbing fixtures as may be necessary until completion of the work. The Contractor shall be responsible for damage or breakage to fixtures and shall make good such damaged items at no cost to the Department.
- C. All exposed polished metal fittings, parts, and devices shall have a protective coating applied and maintained during the course of construction.
- D. Protective coverings and coatings shall be maintained and replaced when so directed by the Department until the work is ready for acceptance.

### **3.7 EXCAVATING, BACKFILLING**

- A. The Plumbing Contractor shall do all excavating, backfilling and concrete work in connection with the work of his contract. Excavate to grade so that the work being installed will rest on solid beds of undisturbed earth. Backfilling shall be done with clean, compactible earth placed in six-inch (6") layers, tamped firm. Remove all obstructions of any kind that may be encountered. Do all cutting and replacing of pavements and other top surfaces as required and secure necessary approvals before proceeding. Remove all surplus excavated materials and dispose of as directed. No work shall be laid on ground of insufficient bearing quality or unstable condition unless provided with approved means of support. All excess earth and rock from excavating shall be deposited where directed.
- B. Where rock or demolition debris is encountered, Excavate the trench to a depth six inches (6") below pipe invert. Place a good compactible fill over the rock to provide a cushion for the pipe.
- C. Where earth is of such character as to be unstable, provide shoring and sheet piling as may be necessary to support the banks and prevent movement of earth into excavation. Provide and operate pumping equipment where necessary to keep trenches clear of water.
- D. Unless otherwise noted on the drawings or specified hereinafter, concrete shall be 2500 psi of a 1:2:4 mixture of domestic Portland cement, clean sharp sand and suitable crushed stone passing a commercial three-fourth (3/4) inch screen. Total water content of the mix shall not exceed seven (7) gallons per sack of cement.

- E. Backfilling by Mechanical trades shall comply with General Construction backfilling requirements if so given.

### **3.8 CUTTING AND PATCHING**

- A. Plumbing Contractor shall do all cutting and patching necessary to properly install their materials, except as noted hereafter. This shall include cutting of existing concrete floors and walls. Cutting and patching of every nature required in connection with this Contract shall be done with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes.
- B. All cutting in the building shall be done with great care so as not to leave an unsightly surface that may not be concealed by plates, escutcheons, or other normal concealing construction. If such unsightly conditions occur through fault of the Contractor, they shall be required to correct such deficiencies to the satisfaction of the Professional.
- C. All holes for piping shall be core drilled through existing concrete floors and walls.
- D. No cutting of structural members shall be done until approval has been received from the Professional.
- E. Plumbing Contractor shall provide the General Contractor or any other Contractors, which may be affected by his work, locations and sizes of chases, sleeves, and openings required for installation of pipes, ducts, and other equipment. This information shall be presented to the General Contractor previous to pouring concrete, or erecting walls to avoid unnecessary cutting and patching.
- F. If openings are omitted or are incorrect through failure of the contractors to follow these instructions, the respective Contractors shall, at their own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Professional/Professional.

### **3.9 EQUIPMENT INSTALLATION AND CONNECTIONS**

- A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, valves, and electric connections recommended by the manufacturer or required for proper operation shall be provided.
- B. Any conflicts between the installation instructions indicated on the contract documents and the manufacturer's instructions and recommendations shall be brought to the attention of the Professional for resolution. The Professional's decision as to the final equipment installation and connections is final and any modifications necessary to obtain such an installation shall be made at no expense to the Institution.

### **3.10 FIRESTOPPING - INSPECTION**

- A. Do not cover any firestopping installation that will become concealed behind other construction until each has been inspected by the Institution's representative, the Construction Manager, and any authorities that may have jurisdiction. Any discrepancies in firestopping shall be corrected prior to further construction.

### **3.11 ROOF WORK**

- A. Contractor shall engage an authorized roofing contractor to provide all work required on any existing roofs. Installation of equipment supports, fan curbs, and piping penetrations shall not invalidate warranty of the existing roof.
- B. Contractor shall submit a letter from the roof manufacturer at the conclusion of the project stating that work performed has not invalidated the existing roof warranty.

### **3.12 FLASHING**

- A. Openings for pipes and ductwork through waterproofed floors and roof areas shall be flashed. Vent pipes shall be flashed with 4-lb. Sheet lead, 24 inches square. Flashing shall be extended up around vents, which shall terminate not less than 18 inches above roof, and shall be fastened under vent caps.

### **3.13 PAINTING**

- A. Clean and prepare all exposed mechanical work for painting. Painting, except for touch-up work as specified hereafter, is covered under Section 09, "Painting".
- B. Upon completion of the job all equipment furnished with a factory finish shall be touched up or repainted by this Contractor as required to remove all scratches, nicks, rust, etc.

### **3.14 PIPE LINE IDENTIFICATION**

- A. Interior pipes shall be painted the same color as the adjacent surface. All piping, interior and exterior, shall be marked with an applicable color band upon which is stenciled or written the legend indicating the contents of the pipe. These bands shall be applied at valves and couplings and wherever pipes pass through walls; partitions are excepted. Pipes, not on walls, shall be painted the same color as equipment to which they are joined or they shall be painted with an aluminum paint.
- B. Following standards shall be referred to as applicable:
  - 1. American Standards Association, Bulletin A-13-1947- for Identification of Piping.
  - 2. Safe Practices, Pamphlet #88 of the National Safety Council, Incorporated Identification of Piping Systems.

### **3.15 MOUNTING MECHANICAL DEVICES IN SUSPENDED CEILINGS**

- A. Support light troffers, air diffusers, grilles, etc. by supplementary hangers located within 6" of each corner. If the weight of the components causes the total dead load to exceed deflection capability of the main runners or cross runners, the components shall be supported independently of the suspension system by the installer of the components placed in ceiling.

**END OF SECTION**

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**SECTION 220519**  
**METERS AND GAGES FOR PLUMBING PIPING**

**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. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.

**1.3 ACTION SUBMITTALS**

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

**1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of meter and gage.

**1.5 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Inc.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Tel-Tru Manufacturing Company.
  - b. Trerice, H. O. Co.
  - c. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass .
8. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ashcroft Inc.
  - b. Trerice, H. O. Co.
  - c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 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.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install thermowells with socket extending one-third of pipe diameter 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 remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
  1. Inlet and outlet of each water heater.
  2. Inlets and outlets of each domestic water heat exchanger.
  3. Inlet and outlet of each domestic hot-water storage tank.
  4. Inlet and outlet of each remote domestic water chiller.
- K. 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.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

### **3.2 THERMOMETER SCHEDULE**

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Metal case, industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

### **3.3 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: 0 to 250 deg F.

### **3.4 PRESSURE-GAGE SCHEDULE**

- A. Pressure gages at discharge of each water service into building shall be one of the following:
  - 1. Liquid-filled, direct-mounted, metal case.
  - 2. Sealed, direct-mounted, plastic case.
- B. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
  - 1. Liquid-filled, direct-mounted, metal case.
  - 2. Sealed, direct-mounted, plastic case.
  - 3. Test plug with EPDM self-sealing rubber inserts.

### **3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Water Piping: 0 to 160 psi.

**END OF SECTION**

**SECTION 220523.12**  
**BALL VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 3. ASME B16.18 for solder-joint connections.
  - 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. 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.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. 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.

**2.2 BRASS BALL VALVES**

- A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 600 psig.
    - c. Body Design: Two piece.

- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

### **2.3 BRONZE BALL VALVES**

#### **A. Bronze Ball Valves, One-Piece:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Flow Controls; Conbraco Industries, Inc.
  - b. FNW; Ferguson Enterprises, Inc.
  - c. NIBCO INC.
- 2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 400 psig.
  - c. Body Design: One piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE.
  - g. Stem: Bronze.
  - h. Ball: Chrome-plated brass.
  - i. Port: Reduced.

#### **B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Flow Controls; Conbraco Industries, Inc.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
- 2. Description:
  - a. Standard: MSS SP-110.
  - 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.

## **PART 3 - EXECUTION**

### **3.1 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

### **3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified 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 is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

### **3.3 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. Brass ball valves, one piece.
  - 3. Bronze ball valve, one piece with bronze trim.
  - 4. Brass ball valves, two-piece with full port and brass trim.
  - 5. Bronze ball valves, two-piece with full port and bronze or brass trim.

### **3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Brass ball valve, one piece.
  - 3. Bronze ball valve, one piece with bronze trim.
  - 4. Brass ball valves, two-piece with full port and brass trim.
  - 5. Bronze ball valves, two-piece with full port and bronze or brass trim.

**END OF SECTION**

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**SECTION 220523.14**  
**CHECK VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Bronze swing check valves.
  - 2. Iron swing check valves.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

**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 B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 4. ASME B16.18 for solder joint.
  - 5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. 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.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

**2.2 BRONZE SWING CHECK VALVES**

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded or soldered. See valve schedule articles.
    - f. Disc: Bronze.

- B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded or soldered. See valve schedule articles.
    - f. Disc: PTFE.

### **2.3 IRON SWING CHECK VALVES**

- A. Iron Swing Check Valves with Metal Seats, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged or threaded. See valve schedule articles.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.
- B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane; Crane Energy Flow Solutions.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged or threaded. See valve schedule articles.
    - f. Trim: Composition.
    - g. Seat Ring: Bronze.
    - h. Disc Holder: Bronze.

- i. Disc: PTFE.
- j. Gasket: Asbestos free.

## **PART 3 - EXECUTION**

### **3.1 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

### **3.2 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.

### **3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. 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; 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.
  - B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
  - C. End Connections:
    - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
    - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
    - 3. For Copper Tubing, NPS 5 and Larger: Flanged.
    - 4. For Steel Piping, NPS 2 and Smaller: Threaded.
    - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
    - 6. For Steel Piping, NPS 5 and Larger: Flanged.

### **3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)**

- A. Pipe NPS 2 and Smaller:
  - 1. Horizontal and Vertical Applications: Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.

### **3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller: Bronze swing check valves bronze disc, Class 125, with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron swing check valves with nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.

**END OF SECTION**

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## SECTION 220529

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal hanger-shield inserts.
  - 4. Fastener systems.
  - 5. Pipe-positioning systems.
  - 6. Equipment supports.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
  - 3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment".

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations.
- 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.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

##### 1.4 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 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- 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.

## **2.2 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, hot-dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
  - 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 and Tube Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## **2.3 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## **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 552, Type II cellular glass 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.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - c. MKT Fastening, LLC.

- B. Mechanical-Expansion Anchors: 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B-line, an Eaton business.
    - b. Empire Tool and Manufacturing Co., Inc.
    - c. Hilti, Inc.
  - 2. Indoor Applications: Zinc-coated or stainless steel.
  - 3. Outdoor Applications: Stainless steel.

## **2.6 PIPE-POSITIONING SYSTEMS**

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## **2.7 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

## **2.8 MATERIALS**

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, 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 078413 "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 MSS SP-58. 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 A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

- D. 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.
- E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- 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.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.
    - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating Below Ambient Air Temperature: 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.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

### **3.3 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. 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.

### **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 Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

### **3.7 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use 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. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

**END OF SECTION**

**SECTION 220553**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

**1.2 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. LEM Products Inc.
  2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  3. Letter Color: White.
  4. Background Color: Black.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. LEM Products Inc.
  2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  3. Letter Color: White.
  4. Background Color: Black.
  5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  8. Fasteners: Stainless-steel rivets or self-tapping screws.
  9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## **2.2 WARNING SIGNS AND LABELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. LEM Products Inc.
  3. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

## **2.3 PIPE LABELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. LEM Products Inc.
  3. Marking Sevcics Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

### **PART 3 - EXECUTION**

#### **3.1 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

#### **3.2 PIPE LABEL INSTALLATION**

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  - 1. Natural Gas Piping:
    - a. Background: Safety yellow.
    - b. Letter Colors: Black.
  - 2. Domestic Water Piping
    - a. Background: Safety green.
    - b. Letter Colors: White.
  - 3. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Safety black.
    - b. Letter Color: White.

**END OF SECTION**

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**SECTION 220719**  
**PLUMBING PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold and hot-water piping.
  - 2. Domestic recirculating hot-water piping.
  - 3. Sanitary waste piping exposed to freezing conditions.
  - 4. Storm-water piping exposed to freezing conditions.
  - 5. Roof drains and rainwater leaders.
  - 6. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Section 220716 "Plumbing Equipment Insulation."

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.4 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **PART 2 - PRODUCTS**

### **2.1 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Manson Insulation Inc.
  - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### **2.2 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. Foster Brand; H. B. Fuller Construction Products.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.

- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. P.I.C. Plastics, Inc.

### **2.3 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller Construction Products.
    - c. Knauf Insulation.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Knauf Insulation.
    - e. Mon-Eco Industries, Inc.
  - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: 60 percent by volume and 66 percent by weight.
  - 5. Color: White.

## 2.4 SEALANTS

### A. Joint Sealants for Cellular-Glass Products:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products.
  - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

### B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

## 2.5 FACTORY-APPLIED JACKETS

### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. 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.

## 2.6 FIELD-APPLIED JACKETS

### A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

### B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Johns Manville; a Berkshire Hathaway company.
  - b. P.I.C. Plastics, Inc.
  - c. Proto Corporation.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. ITW Insulation Systems; Illinois Tool Works, Inc.
  2. Factory cut and rolled to size.
  3. Finish and thickness are indicated in field-applied jacket schedules.
  4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  5. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
  6. Factory-Fabricated Fitting Covers:
    - a. Same material, finish, and thickness as jacket.
    - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - c. Tee covers.
    - d. Flange and union covers.
    - e. End caps.
    - f. Beveled collars.
    - g. Valve covers.
    - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Compac Corporation.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.
  - 5. Elongation: 5 percent.
  - 6. Tensile Strength: 34 lbf/inch in width.

## 2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. ITW Insulation Systems; Illinois Tool Works, Inc.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

## **2.9 PROTECTIVE SHIELDING GUARDS**

- A. Protective Shielding Pipe Covers,:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGuire Manufacturing.
    - b. Plumberex Specialty Products, Inc.
    - c. Truebro.
  - 2. 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. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Truebro.
  - 2. 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 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. 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.

### 3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.

- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- 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 078413 "Penetration Firestopping."

### **3.4 GENERAL PIPE INSULATION INSTALLATION**

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### **3.5 INSTALLATION OF 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.

### **3.6 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.

### **3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE 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.

### **3.8 FIELD-APPLIED JACKET INSTALLATION**

- A. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. 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.

- C. 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.

### **3.9 FINISHES**

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. 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.

### **3.10 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### **3.11 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.

### **3.12 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold, Hot and Recirculated Hot Water: Insulation shall be one of the following:
  - 1. Flexible Elastomeric: 3/4 inch thick.
  - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Stormwater and Overflow: Insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3. Polyolefin: 1 inch thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
  1. Flexible Elastomeric: 1/2 inch thick.
  2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

### **3.13 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.
  2. PVC: 20 mils thick.
  3. Aluminum, Corrugated: 0.016 inch thick.
- D. Piping, Exposed:
  1. None.
  2. PVC: 20 mils thick.
  3. Aluminum, Corrugated: 0.016 inch thick.

**END OF SECTION**

**SECTION 221116**  
**DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. PEX tube and fittings.
  - 3. Piping joining materials.
  - 4. Transition fittings.
  - 5. Dielectric fittings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.

**1.3 INFORMATIONAL SUBMITTALS**

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

**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 372 for low lead.

**2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- 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 Pressure-Seal-Joint Fittings:
  - 1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- G. Copper Push-on-Joint Fittings:
  - 1. Copper Push-on-Joint Fittings are **not allowed** on this project.

### **2.3 PEX TUBE AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. REHAU.
  - 2. Uponor.
  - 3. Viega LLC.
- B. Tube Material: PEX plastic according to ASTM F 876 and ASTM F 877.
- C. Fittings: ASTM F 1960, cold expansion fittings and reinforcing rings.
- D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

### **2.4 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

### **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. Plastic-to-Metal Transition Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. Harvel Plastics, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Spears Manufacturing Company.
  - 2. 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.

- D. Plastic-to-Metal Transition Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Colonial Engineering, Inc.
    - b. NIBCO INC.
  - 2. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Central Plastics Company.
    - b. WATTS.
    - c. Wilkins.
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Central Plastics Company.
    - b. WATTS.
    - c. Wilkins.
  - 2. Standard: ASSE 1079.
  - 3. Factory-fabricated, bolted, companion-flange assembly.
  - 4. Pressure Rating: 125 psig minimum at 180 deg F.
  - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
  - 2. Nonconducting materials for field assembly of companion flanges.
  - 3. Pressure Rating: 150 psig.

4. Gasket: Neoprene or phenolic.
  5. Bolt Sleeves: Phenolic or polyethylene.
  6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Grinnell Mechanical Products.
    - b. Matco-Norca.
    - c. Precision Plumbing Products.
  2. Standard: IAPMO PS 66.
  3. Electroplated steel nipple complying with ASTM F 1545.
  4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  5. End Connections: Male threaded or grooved.
  6. Lining: Inert and noncorrosive, propylene.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and 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 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 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. 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.

- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. 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.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- 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 220519 "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "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 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. 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," "Brazed 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. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- 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 PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.
- I. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.

- J. 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.

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "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.
  7. NPS 6: 12 feet with 3/4-inch rod.
  8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.
- J. Install hangers for vertical PEX tubing every 48 inches.
- K. 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 220553 "Identification for Plumbing Piping and Equipment."
- 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. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
  - C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.12 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 L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. PEX tube, NPS 1 and smaller.
    - a. Fittings for PEX tube:
      - 1) ASTM F 1807, metal insert and copper crimp rings.
      - 2) ASTM F 1960, cold expansion fittings and reinforcing rings.
    - b. Minimum size allowed is ¾".
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

**END OF SECTION**

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**SECTION 221119**  
**DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Strainers for domestic water piping.
8. Outlet boxes.
9. Hose stations.
10. Hose bibbs.
11. Wall hydrants.
12. Ground hydrants.
13. Post hydrants.
14. Roof hydrants.
15. Drain valves.
16. Water-hammer arresters.
17. Trap-seal primer device.
18. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
2. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
3. Section 221116 "Domestic Water Piping" for water meters.
4. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

**1.3 DEFINITIONS**

- A. AMI: Advanced Metering Infrastructure.
- B. AMR: Automatic Meter Reading.
- C. FKM: A family of fluoroelastomer materials defined by ASTM D1418.

**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. Test and inspection reports.
- B. 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. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 20 PSIG unless otherwise indicated.

### **2.3 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Apollo
  - 2. Standard: ASSE 1001.
  - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: Threaded.
  - 6. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers FPHB-1:
  - 1. Woodford Manufacturing
  - 2. Standard: ASSE 1011.
  - 3. Body: Bronze, nonremovable, with manual drain.
  - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 5. Finish: Chrome or nickel plated.
- C. Pressure Vacuum Breakers:
  - 1. Apollo
  - 2. Standard: ASSE 1020.
  - 3. Operation: Continuous-pressure applications.
  - 4. Pressure Loss: 5 PSIG > maximum, through middle third of flow range.
  - 5. Size: 3/4".
  - 6. Design Flow Rate: 45 GPM.
  - 7. Selected Unit Flow Range Limits: 45 GPM.
  - 8. Pressure Loss at Design Flow Rate: 3 PSIG.

9. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

## **2.4 BALANCING VALVES**

- A. Copper-Alloy Calibrated Balancing Valves CS:
  1. Watts
  2. Type: Ball valve with two readout ports and memory-setting indicator.
  3. Body: Bronze.
  4. Size: Same as connected piping, but not larger than NPS 2.
  5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Memory-Stop Balancing Valves CS:
  1. Apollo
  2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  3. Pressure Rating: 400-psig minimum CWP.
  4. Size: NPS 2 or smaller.
  5. Body: Copper alloy.
  6. Port: Standard or full port.
  7. Ball: Chrome-plated brass or stainless steel.
  8. Seats and Seals: Replaceable.
  9. End Connections: Solder joint or threaded.
  10. Handle: Vinyl-covered steel with memory-setting device.
- C. Automatic Flow Control Balancing Valves CS:
  1. Caleffi North America
  2. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
  3. Pressure Rating: 200 psig.
  4. Size: NPS 2 or smaller.
  5. Body: Stainless steel or brass.
  6. Flow Cartridge: Stainless steel or antiscaling polymer.
  7. End Connections: Threaded or solder joint.

## **2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

- A. Water-Temperature Limiting Devices TMV:
  1. Apollo
  2. Standard: ASSE 1070.
  3. Pressure Rating: 125 psig.
  4. Type: Thermostatically controlled, water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded union inlets and outlet.
  7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Tempered-Water Setting: 110°F (adjustable).
  9. Tempered-Water Design Flow Rate: 0.5 gpm.
  10. Valve Finish: Chrome plated.

- B. Primary, Thermostatic, Water Mixing Valves TMV:
1. Leonard Valve Company
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded inlets and outlet.
  7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Tempered-Water Setting: 110°F (adjustable).
  9. Tempered-Water Design Flow Rate: 13.5 gpm.
  10. Selected Valve Flow Rate at 45-psig Pressure Drop: 210 gpm.
  11. Pressure Drop at Design Flow Rate: 1.0 psig.
  12. Valve Finish: Chrome plated.
  13. Piping Finish: Copper.
  14. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless steel door.
- C. Individual-Fixture, Water Tempering Valves TMV:
1. Acorn Engineering Company
  2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
  3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  4. Material: Bronze body with corrosion-resistant interior components.
  5. Temperature Control: Adjustable.
  6. Connections: Threaded inlets and outlet.
  7. Finish: Chrome plated.
  8. Tempered-Water Setting: 110°F (adjustable).
  9. Tempered-Water Design Flow Rate: 0.5 GPM.
- D. Primary Water Tempering Valves TMV:
1. Watts
  2. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
  3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  4. Material: Bronze body.
  5. Temperature Control: Manual.
  6. Connections: Threaded inlets and outlet.
  7. Selected Primary Water Tempering Valve Size: 1½".
  8. Tempered-Water Setting: 110°F (adjustable).
  9. Tempered-Water Design Flow Rate: 13.5 gpm.
  10. Pressure Drop at Design Flow Rate: 1.0 psig.
  11. Tempered-Water Outlet Size: 1½" NPS end connection.
  12. Cold-Water Inlet Size: 1½" NPS end connection.
  13. Hot-Water Inlet Size: 1½" NPS end connection.

14. Valve Finish: Rough bronze.

## **2.6 STRAINERS FOR DOMESTIC WATER PIPING**

### **A. Y-Pattern Strainers:**

1. Watts
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. 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.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch.
7. Drain: Pipe plug.

## **2.7 OUTLET BOXES**

### **A. Icemaker Outlet Boxes ICE:**

1. Guy Gray, IPS Corporation
2. Mounting: Recessed.
3. Material and Finish: Stainless steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Accessory: Water hammer arrestor.
6. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## **2.8 HOSE BIBBS**

### **A. Hose Bibbs HB-1:**

1. Woodford Manufacturing
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Wheel handle.
15. Include operating key with each operating-key hose bibb.

16. Include wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 WALL HYDRANTS

### A. Freeze Proof Hose Bibbs FPHB-1:

1. Wall hydrants without integral vacuum breakers or backflow preventers are available but not recommended. Wall hydrants are not generally considered devices to convey or dispense water for human consumption; therefore, some manufacturers do not comply with lead-free construction/certification. If Project application requires lead-free construction, confirm availability of product with manufacturers. Insert drawing designation. Use these designations on Drawings to identify each product.

### B. Nonfreeze Vacuum Breaker Wall Hydrants FPHB-1:

1. Woodford Manufacturing.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

## 2.10 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.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.

4. Body: Copper alloy or ASTM B62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

## **2.11 WATER-HAMMER ARRESTERS**

- A. Water-Hammer Arresters:
  1. Mifab
  2. Standard: ASSE 1010 or PDI-WH 201.
  3. Type: Piston.
  4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## **2.12 TRAP-SEAL PRIMER DEVICE**

- A. Supply-Type, Trap-Seal Primer Device:
  1. Watts
  2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
  6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- B. Drainage-Type, Trap-Seal Primer Device:
  1. Mifab, Inc.
  2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
  3. Size: NPS 1-1/4 minimum.
  4. Material: Chrome-plated, cast brass.

## **2.13 FLEXIBLE CONNECTORS**

- A. Flex Hose Co. Inc.
- B. 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.
- C. 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.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF PIPING SPECIALTIES**

- A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
  - C. Water Control Valves: Install with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.
  - D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.
  - E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
  - F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
    1. Install cabinet-type units recessed in or surface mounted on wall as specified.
  - G. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.
  - H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
  - I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
    1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
  - J. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
  - K. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
  - L. Drainage-Type, Trap-Seal Primer Device: Install 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.
  - M. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### **3.2 PIPING CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

### **3.3 ELECTRICAL CONNECTIONS**

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

### **3.4 CONTROL CONNECTIONS**

- A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

### **3.5 IDENTIFICATION**

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  1. Vacuum breakers.
  2. Backflow preventers.
  3. Water pressure-reducing valves.
  4. Automatic water shutoff valve systems.
  5. Balancing valves.
  6. Temperature-actuated, water mixing valves.
  7. Outlet boxes.
  8. Hose stations.
  9. Wall hydrants.
  10. Trap-seal primer systems.
  11. Water meters.
- 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 220553 "Identification for Plumbing Piping and Equipment."

### **3.6 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.
- D. Adjust each double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

### **3.7 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  1. Test each double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
  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 unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

**END OF SECTION**

**SECTION 221123.21**  
**INLINE, DOMESTIC-WATER PUMPS**

**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. In-line, sealless centrifugal pumps.
  - 2. Horizontally mounted, in-line, separately coupled centrifugal pumps.
  - 3. Horizontally mounted, in-line, close-coupled centrifugal pumps.
  - 4. Vertically mounted, in-line, close-coupled centrifugal pumps.
- B. Related Requirements:
  - 1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:

**1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which pumps will be attached.
  - 2. Size and location of initial access modules for acoustical tile.
- B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written instructions for handling.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: UL 778 for motor-operated water pumps.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

### **2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS**

- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- B. Taco
- C. Capacities and Characteristics:
  - 1. Capacity: 0.5 gpm.
  - 2. Total Dynamic Head: 20 feet.
  - 3. Inlet and Outlet Size: 3/4 NPS.
  - 4. Pump Speed: 3250.
  - 5. Pump Control: Aquastat, Thermostat and Timer.
  - 6. Motor Horsepower: 1/40 HP.
  - 7. Electrical Characteristics:
    - a. Volts: 120 V.
    - b. Phase: Single phase.
    - c. Hertz: 60 Hz.
    - d. Full-Load Amperes: 5 A.
    - e. Minimum Circuit Ampacity: 0.43 A.
    - f. Maximum Overcurrent Protection: 5 A.
- D. 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. Minimum Working Pressure: 125 psig.
  - 3. Maximum Continuous Operating Temperature: 140°F.
  - 4. Casing: Bronze, with threaded or companion-flange connections.
  - 5. Impeller: Bronze.
  - 6. Motor: Single speed.

### **2.3 MOTORS**

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "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.

## 2.4 CONTROLS

- A. Pressure Switches: Electric, adjustable for control of Hot water recirc. pump.
  - 1. Type: Water-immersion pressure sensor, for installation in piping.
  - 2. Enclosure: NEMA 250, Type 4X.
  - 3. Operation of Pump: On or off.
  - 4. Transformer: Provide if required.
  - 5. Power Requirement: 120 V ac.
  - 6. Settings: Start pump at 1PSIG and stop pump at 5 PSIG.
- B. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  - 1. Type: Water-immersion temperature sensor, for installation in piping.
  - 2. Range: 50 to 140°F.
  - 3. Enclosure: NEMA 250, Type 4X.
  - 4. Operation of Pump: On or off.
  - 5. Transformer: Provide if required.
  - 6. Power Requirement: 120 V ac.
  - 7. Settings: Start pump at 105 deg F and stop pump at 140 deg F.
- C. Timers: Electric, for control of hot-water circulation pump.
  - 1. Type: Programmable, seven-day clock with manual override on-off switch.
  - 2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
  - 3. Operation of Pump: On or off.
  - 4. Transformer: Provide if required.
  - 5. Power Requirement: 120 V ac.
  - 6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.
- D. Time-Delay Relays: Electric, for control of hot-water circulation pump between water heater and connected hot-water storage tank.
  - 1. Type: Adjustable time-delay relay.
  - 2. Range: Up to five minutes.
  - 3. Setting: Five minutes.
  - 4. Enclosure: NEMA 250, Type 4X.
  - 5. Operation of Pump: On or off.
  - 6. Transformer: Provide if required.
  - 7. Power Requirement: 120 V ac.
  - 8. Programmable Sequence of Operation: Limit pump operation to periods of burner operation, plus maximum five minutes after the burner stops.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

### 3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Mount pumps in orientation complying with manufacturer's written instructions.

- C. Pump Mounting:
  1. 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.
  2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
  1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- E. Install pressure switches in water-supply piping.
- F. Install thermostats in hot-water return piping.
- G. Install timers on wall.
- H. Install time-delay relays in piping between water heaters and hot-water storage tanks.

### **3.3 PIPING CONNECTIONS**

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.
- C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
  1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
    - a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
    - b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    - c. Vertically mounted, in-line, close-coupled centrifugal pumps.
    - d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
- 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 strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:
  1. Section 220523.12 "Ball Valves for Plumbing Piping."
  2. Section 220523.13 "Butterfly Valves for Plumbing Piping."
  3. Section 220523.14 "Check Valves for Plumbing Piping."
  4. Section 220523.15 "Gate Valves for Plumbing Piping."
  5. Install pressure gauge and snubber at suction of each pump and pressure gauge and snubber at discharge of each pump. Install at integral pressure-gauge tapings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

### **3.4 CONTROL CONNECTIONS**

- A. Install control and electrical power wiring to field-mounted control devices.

- B. Connect control wiring between temperature controllers and devices.
- C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

### **3.5 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

### **3.6 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

### **3.7 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, timers and aquastat 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.

### **3.8 ADJUSTING**

- A. Adjust inline, 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 221313**  
**FACILITY SANITARY SEWERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
  - 2. Hubless cast-iron soil pipe and fittings.
  - 3. Cleanouts.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings:
  - 1. Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- B. Product Certificates: For each type of pipe and fitting.
- C. Field quality-control reports.

**PART 2 - PRODUCTS**

**2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A74, Service class.
- B. Gaskets: ASTM C564, rubber.
- C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

**2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A888 or CISPI 301.
- B. CISPI-Trademark, Shielded Couplings:
  - 1. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Charlotte Pipe and Foundry Company.
    - c. Dallas Specialty & Mfg. Co.
    - d. Fernco Inc.
    - e. Mission Rubber Company, LLC; a division of MCP Industries.
    - f. Tyler Pipe; a subsidiary of McWane Inc.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C1277 and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ANACO-Husky.
  - b. Clamp-All Corp.
  - c. Dallas Specialty & Mfg. Co.
  - d. Mission Rubber Company, LLC; a division of MCP Industries.
  - e. Tyler Pipe; a subsidiary of McWane Inc.

### 2.3 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

B. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, **SDR 35**, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

### 2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C564, rubber.
2. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
3. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Dallas Specialty & Mfg. Co.
  - b. Fernco Inc.
  - c. Logan Clay Pipe.
  - d. Mission Rubber Company, LLC; a division of MCP Industries.
  - e. NDS Inc.
  - f. Plastic Oddities.

- D. Ring-Type, Flexible Couplings:
  - 1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fernco Inc.
    - b. Logan Clay Pipe.
    - c. Mission Rubber Company, LLC; a division of MCP Industries.
- E. Nonpressure-Type, Rigid Couplings:
  - 1. Description: ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. ANACO-Husky.

## 2.5 CLEANOUTS

- A. Cast-Iron Cleanouts:
  - 1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg Co; a division of Morris Group International.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. Tyler Pipe; a subsidiary of McWane Inc.
    - e. WATTS.
    - f. Zurn Industries, LLC.
  - 3. Top-Loading Classification(s): Light Duty and Heavy Duty.
  - 4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

## 2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A674 or AWWA C105/A21.5.
- 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: tube.
- D. Color: Black.

## 2.7 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
  - 1. Cement: ASTM C150/C150M, Type II.
  - 2. Fine Aggregate: ASTM C33/C33M, sand.
  - 3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
  - 4. Water: Potable.

- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
  - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
  - 3. Install piping with 36-inch minimum cover.
  - 4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 6. Install PVC corrugated sewer piping according to ASTM D2321 and ASTM F1668.
  - 7. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.
- G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 or AWWA C105/A21.5:
  - 1. Hub-and-spigot, cast-iron soil pipe.
  - 2. Hubless cast-iron soil pipe and fittings.
  - 3. Expansion joints and deflection fittings.

- H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

### **3.3 PIPE JOINT CONSTRUCTION**

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
  - 1. 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.
  - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
  - 3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
  - 4. Join PVC corrugated sewer piping according to ASTM D2321.
  - 5. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
  - 6. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
  - 1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    - a. Unshielded flexible couplings for pipes of same or slightly different OD.
    - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

### **3.4 CLEANOUT INSTALLATION**

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  - 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### **3.5 CONNECTIONS**

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
  - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
  - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

### **3.6 CLOSING ABANDONED SANITARY SEWER SYSTEMS**

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Section 312000 "Earth Moving."

### **3.7 IDENTIFICATION**

- A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
  1. Use warning tape or detectable warning tape over ferrous piping.
  2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### **3.8 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  1. Submit separate report for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Manholes: Perform hydraulic test according to ASTM C969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**

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**SECTION 221316  
SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Hubless, cast-iron soil pipe and fittings.
  - 2. PVC pipe and fittings.
  - 3. Specialty pipe fittings.

**1.2 ACTION SUBMITTALS**

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

**1.3 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

**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 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Dallas Specialty & Mfg. Co.
    - c. Fernco Inc.
    - d. Matco-Norca, Inc.
    - e. MIFAB, Inc.
    - f. Mission Rubber Company; a division of MCP Industries, Inc.
    - g. Stant.
    - h. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ANACO-Husky.
  - b. Clamp-All Corp.
  - c. Dallas Specialty & Mfg. Co.
  - d. MIFAB, Inc.
  - e. Mission Rubber Company; a division of MCP Industries, Inc.
  - f. Stant.
  - g. Tyler Pipe.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

**2.4 PVC PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

**2.5 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) Fernco Inc.
      - 3) Froet Industries LLC.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. End Connections: Same size as and compatible with pipes to be joined.
    - e. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - 1) Cascade Waterworks Mfg. Co.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. End Connections: Same size as and compatible with pipes to be joined.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "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. Building 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. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
  - 3. 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."
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Plumbing Specialties:
  - 1. Install backwater valves in sanitary waster gravity-flow piping.
    - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 3. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- 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 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. 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.

- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

### **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: Shielded, nonpressure transition couplings.

### **3.5 VALVE INSTALLATION**

- A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
  - 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.
  - 4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls 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, valve, 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. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. 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 PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical PVC piping every 48 inches.
- 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. Install horizontal backwater valves with cleanout cover flush with floor.
  - 6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

7. 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 220553 "Identification for Plumbing Piping and Equipment."

### **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. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. 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. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure 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. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent 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. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION**

**SECTION 221319**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Backwater valves.
  - 2. Cleanouts.
  - 3. Roof flashing assemblies.
  - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
  - 2. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
  - 3. Section 334200 "Stormwater Conveyance" for storm drainage piping and piping specialties outside the building.

**1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

**2.2 BACKWATER VALVES**

- A. Horizontal, Cast-Iron Backwater Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. Tyler Pipe; a subsidiary of McWane Inc.
    - e. WATTS.
  - 2. Standard: ASME A112.14.1.
  - 3. Size: Same as connected piping.
  - 4. Body: Cast iron.
  - 5. Cover: Cast iron with bolted or threaded access check valve.
  - 6. End Connections: Hubless.

7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
  8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
- B. Horizontal, Plastic Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Canplas LLC.
    - b. IPS Corporation.
    - c. NDS Inc.
    - d. Oatey.
    - e. Plastic Oddities.
    - f. Sioux Chief Manufacturing Company, Inc.
  2. Size: Same as connected piping.
  3. Body: PVC.
  4. Cover: Same material as body with threaded access to check valve.
  5. Check Valve: Removable swing check.
  6. End Connections: Socket type.

## **2.3 CLEANOUTS**

- A. Cast-Iron Exposed Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. Tyler Pipe; a subsidiary of McWane Inc.
    - e. WATTS.
  2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  3. Size: Same as connected drainage piping
  4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  5. Closure: Countersunk or raised-head, brass or plastic plug.
  6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  7. Closure: Stainless-steel plug with seal.
- B. Cast-Iron Exposed Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. Oatey.
    - d. Sioux Chief Manufacturing Company, Inc.
    - e. Tyler Pipe; a subsidiary of McWane Inc.
    - f. WATTS.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with setscrews or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg. Co.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Tyler Pipe; a subsidiary of McWane Inc.
  - e. WATTS.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. 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.
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.

D. Plastic Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Canplas LLC.
  - b. IPS Corporation.
  - c. NDS Inc.
  - d. Plastic Oddities.
  - e. Sioux Chief Manufacturing Company, Inc.
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.

5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

## **2.4 ROOF FLASHING ASSEMBLIES**

### **A. Roof Flashing Assemblies:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-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.
  - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
  - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## **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 with increaser fitting of size indicated.

### **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. 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.

### **D. 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.

### **E. 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.

- F. Expansion Joints:
  - 1. Standard: ASME A112.6.4.
  - 2. Body: Cast iron with bronze sleeve, packing, and gland.
  - 3. End Connections: Matching connected piping.
  - 4. Size: Same as connected soil, waste, or vent piping.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install backwater valves in building drain piping.
  - 1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- 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 Section 076200, Sheet Metal Flashing and Trim.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.
- G. Assemble open drain fittings and install with top of hub 1 inch above floor.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- L. Install wood-blocking reinforcement for wall-mounting-type specialties.
- M. 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 221316 "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 260526 "Grounding and Bonding for Electrical Systems."

- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FLASHING INSTALLATION**

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- 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 Section 076200 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### **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 220553 "Identification for Plumbing Piping and Equipment."

### **3.5 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 221319.13  
SANITARY DRAINS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Floor drains.

**1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

**1.3 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.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

**2.2 FLOOR DRAINS**

- A. Cast-Iron Floor Drains:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. Wade; a subsidiary of McWane Inc.
    - d. WATTS.
  - 2. Standard: ASME A112.6.3.
  - 3. Pattern: Floor drain.
  - 4. Body Material: Gray iron.
  - 5. Seepage Flange: Not Required.
  - 6. Anchor Flange: Required.
  - 7. Clamping Device: Not required.
  - 8. Outlet: Bottom.
  - 9. Backwater Valve: Not required.
  - 10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
  - 11. Sediment Bucket: See schedule on drawings.
  - 12. Top or Strainer Material: Nickel bronze.
  - 13. Top of Body and Strainer Finish: Nickel bronze.
  - 14. Top Shape: Round.
  - 15. Dimensions of Top or Strainer: See schedule on drawings .

16. Top Loading Classification: Heavy Duty.
17. Funnel: Not required.
18. Inlet Fitting: Not required.
19. Trap Material: Cast iron.
20. Trap Pattern: Deep-seal P-trap.
21. Trap Features: Not required.

## **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.
  2. Install on support devices, so that top will be flush with adjacent surface.
- C. Install open drain fittings with top of hub 1 inch above floor.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Comply with requirements in Section 221323 "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 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "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 220553 "Identification for Plumbing Piping and Equipment."

### **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**

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**SECTION 221413**  
**FACILITY STORM DRAINAGE PIPING**

**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. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Ductile-iron pipe and fittings.
5. Copper tube and fittings.
6. ABS pipe and fittings.
7. PVC pipe and fittings.
8. Specialty pipe and fittings.
9. Encasement for underground metal piping.

- B. Related Requirements:

1. Section 334400 "Stormwater Utility Equipment" for storm drainage piping outside the building.

**1.3 ACTION SUBMITTALS**

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

**1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Detail storm drainage piping. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which drainage piping will be attached or suspended from.

- B. Field quality-control reports.

**1.5 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

**1.6 FIELD CONDITIONS**

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect 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 Architect'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. Storm Drainage Piping: 10-foot head of water.

### **2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Tyler Pipe
- B. Pipe and Fittings:
  - 1. Marked with CISPI collective trademark and NSF certification mark.
  - 2. Class: ASTM A 74, Service class(es).
- C. Gaskets: ASTM C 564, rubber.
- D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Tyler Pipe
- B. CISPI, Hubless-Piping Couplings:
  - 1. Tyler Pipe
  - 2. Couplings shall bear CISPI collective trademark.
  - 3. Standards: ASTM C 1277 and CISPI 310.
  - 4. 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. Tyler Pipe
  - 2. Standard: ASTM C 1540.
  - 3. 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. Charlotte Pipe and Foundry
  - 2. Standard: ASTM C 1277.
  - 3. 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 GALVANIZED-STEEL PIPE AND FITTINGS**

- A. US Steel
- B. Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.
- C. Cast-Iron Drainage Fittings: ASME B16.12, threaded.
- D. Steel-Pipe Pressure Fittings:
  - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
  - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

- E. Cast-Iron Flanges: ASME B16.1, Class 125.
  - 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.
- F. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances
  - 1. Victaulic Company
  - 2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged-steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
  - 3. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

## 2.5 DUCTILE-IRON PIPE AND FITTINGS

- A. American Ductile Iron Pipe.
- B. Ductile-Iron, Mechanical-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  - 3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Ductile-Iron, Push-on-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  - 3. Gaskets: AWWA C111/A21.11, rubber.
- D. Ductile-Iron, Grooved-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.
  - 2. Ductile-Iron, Grooved-End Pipe Appurtenances:
    - a. Victaulic Company
    - b. Grooved-End, Ductile-Iron Fittings: ASTM A 536, ductile-iron castings with dimensions matching AWWA C110/A21.10, ductile-iron pipe or AWWA C153/A21.53, ductile-iron fittings; complying with AWWA C606 for grooved ends.
    - c. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

## 2.6 COPPER TUBE AND FITTINGS

- A. Cambridge-Lee Industries, LLC
- B. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- C. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.
- D. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

- E. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- F. Copper Pressure Fittings:
  - 1. Copper Fittings: ASME B16.18, cast-copper-alloy fittings 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.
- G. 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.
- H. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## **2.7 ABS PIPE AND FITTINGS**

- A. JM Eagle Manufacturing Co.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- D. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
- E. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- F. Solvent Cement: ASTM D 2235.

## **2.8 PVC PIPE AND FITTINGS**

- A. JM Eagle Manufacturing Co.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.
- D. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- E. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- F. Adhesive Primer: ASTM F 656.
- G. Solvent Cement: ASTM D 2564.

## **2.9 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. Dallas Specialty & Mfg.Co.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

- d. Sleeve Materials:
  - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 4. Shielded, Nonpressure Transition Couplings:
  - a. Mission Rubber Co.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. End Connections: Same size as and compatible with pipes to be joined.
- 5. Pressure Transition Couplings:
  - a. Ford Meter Box Co. Inc.
  - b. Standard: AWWA C219.
  - c. Description: Metal, sleeve-type couplings same size as pipes to be joined, and with pressure rating at least equal to and ends compatible with pipes to be joined.
  - d. Center-Sleeve Material: Manufacturer's standard, Ductile iron.
  - e. Gasket Material: Natural or synthetic rubber.
  - f. Metal Component Finish: Corrosion-resistant coating or material.
- 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. Watts
    - b. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 150 psig.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  - 3. Dielectric Flanges:
    - a. Watts
    - b. Description:
      - 1) Standard: ASSE 1079.
      - 2) Factory-fabricated, bolted, companion-flange assembly.
      - 3) Pressure Rating: 150 psig minimum at 180°F.
      - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
  - 4. Dielectric-Flange Insulating Kits:
    - a. Advance Products & Systems, LLC
    - b. 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.
5. Dielectric Nipples:
- a. Victaulic Co.
  - b. Description: Electroplated steel nipple.
  - c. Standard: IAPMO PS 66.
  - d. Pressure Rating: 300 psig at 225 deg F.
  - e. End Connections: Male threaded or grooved.
  - f. Lining: Inert and noncorrosive, propylene.

## **2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING**

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: High-density, crosslaminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: tube.
- D. Color: Black..

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 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 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 to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
  - 1. Do not change direction of flow more than 90 degrees.
  - 2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building 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 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.
- 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. Install aboveground ABS piping according to ASTM D 2661.
- R. Install aboveground PVC piping according to ASTM D 2665.
- S. Install underground PVC piping according to ASTM D 2321.
- T. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.
- U. Install underground, ductile-iron, force-main piping according to AWWA C600.
  - 1. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.
  - 2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  - 3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- W. Install force mains at elevations indicated.
- X. Plumbing Specialties:
  - 1. Install backwater valves in storm drainage gravity-flow piping.
    - a. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.
    - a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

- b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
  - 3. Install drains in storm drainage gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Z. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- AA. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- BB. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 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 Caulked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
- C. Hubless, Cast-Iron Soil Piping Coupled Joints:
  - 1. 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.
  - 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 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. 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.
- H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendices.

3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendices.
- I. Joint Restraints and Sway Bracing:
  1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
    - a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
    - b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
    - c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

### **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: Shielded, nonpressure transition couplings.
  3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
  4. In Underground Force-Main Piping:
    - a. NPS 1-1/2 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 to NPS 4: Use dielectric flanges.
  4. Dielectric Fittings for NPS 6 and Larger: Use dielectric flange kits.

### **3.5 VALVE INSTALLATION**

- A. General valve installation requirements for general-duty valve installations are specified in the following Sections:
  1. Section 220523.14 "Check Valves for Plumbing Piping."
- B. Shutoff Valves:
  1. Install shutoff valve on each sump pump discharge.
  2. Install full port ball valve for piping NS 2 and smaller.
  3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  2. Install backwater valves in accessible locations.
  3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

### **3.6 INSTALLATION OF HANGERS AND SUPPORTS**

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- B. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 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. Install hangers for cast-iron, ductile iron and copper soil tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping and tubing within 12 inches of each fitting, valve and coupling.
- F. Support vertical cast-iron, ductile iron and copper tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.
- G. Support vertical ABS and PVC piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves with cleanout cover flush with floor.
  - 3. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- D. Connect force-main piping to the following:
  - 1. Storm Sewer: To exterior force main.
  - 2. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance.
- F. 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 storm drainage piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### **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.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. 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.
    - 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 storm drainage piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure:
    - a. Test storm drainage piping, except outside leaders, on completion of roughing-in.
    - b. 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.
- C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
    - a. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 4. Prepare reports for tests and required corrective action.
- D. Piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.10 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.

- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.11 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 the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  - 4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  - 4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  - 5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground storm drainage piping NPS 6 and smaller shall be the following:
  - 1. **Service** class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; cast-iron, hubless-piping couplings; and coupled joints.
  - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, storm drainage piping NPS 8 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; cast-iron, hubless-piping couplings; and coupled joints.
  - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 4. Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be the following:
  - 1. Hard copper tube, Type L copper pressure fittings, and soldered joints.
  - 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be the following:
  - 1. Hard copper tube, Type L copper pressure fittings, and soldered joints.
  - 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
  - 3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
  - 4. Fitting-type transition couplings if dissimilar pipe materials.

- H. Underground storm drainage force mains NPS 4 and smaller shall be the following:
1. Hard copper tube; Type L wrought-copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Ductile-iron, push-on-joint piping and push-on joints.
  4. Ductile-iron, grooved-joint piping and grooved joints.
  5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

**END OF SECTION**

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**SECTION 221423**  
**STORM DRAINAGE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal roof drains.
  - 2. Plastic roof drains.
  - 3. Miscellaneous storm drainage piping specialties.
  - 4. Cleanouts.
  - 5. Backwater valves.
  - 6. Trench drains.
  - 7. Channel drainage systems.
- B. Related Requirements:
  - 1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
  - 2. Section 078413 "Penetration Firestopping" for firestopping roof penetrations.

**1.3 ACTION SUBMITTALS**

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

**1.4 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 METAL ROOF DRAINS**

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains RD-ORD-1:
  - 1. Zurn Industries, LLC
  - 2. Standard: ASME A112.6.4.
  - 3. Body Material: Cast iron.
  - 4. Dimension of Body: Nominal 14-diameter.
  - 5. Combination Flashing Ring and Gravel Stop: Required.
  - 6. Flow-Control Weirs: Required.
  - 7. Outlet: Bottom.
  - 8. Outlet Type: Inside caulk, Threaded..
  - 9. Extension Collars: Required.
  - 10. Underdeck Clamp: Required.
  - 11. Expansion Joint: Required.
  - 12. Sump Receiver Plate: Required.
  - 13. Dome Material: Cast iron,PE.
  - 14. Perforated Gravel Guard: Stainless steel.
  - 15. Vandal-Proof Dome: Not required.

16. Water Dam: 2 inches high.

## **2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**

### **A. Downspout Adapters:**

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

### **B. Downspout Boots:**

1. Watts
2. Description: Manufactured, ASTM A48/A48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
3. Size: Inlet size to match downspout and NPS 4 outlet.

### **C. Metal Downspout Nozzles DSN-1:**

1. Jay R. Smith MFG CO, Watts, Zurn, Josam Co.
2. Description: Nozzle with wall flange and mounting holes to cover rough opening and serve as anchor..
3. Size: Same as connected downspout.
4. Material: Cast bronze or nickel bronze nozzle and flange.
5. Piping Connection Type: Threaded or Slip on.
6. Finish: Bronze.
7. Opening Protection: Birdscreen.

## **2.3 CLEANOUTS**

### **A. Cast-Iron Exposed Cleanouts FCO:**

1. J R smith MFG CO, Josam Co, Watts, Zurn Industries, LLC.
2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, No-hub, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass, cast-iron, plastic(exterior) non-traffic areas. plug.
6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

### **B. Cast-Iron Exposed Floor Cleanouts FCO:**

1. JR Smith Mfg CO, Josam CO, Sioux Chief Manuf., Watts, Zurn.
2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Adjustable housing, Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket, Cast-iron plug, Plastic plug.
9. Adjustable Housing Material: Cast iron, Plastic with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round.
  12. Top Loading Classification: Extra-Heavy, Light, Medium] Duty.
  13. Riser: ASTM A74, Extra-Heavy, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts WCO:
1. JR Smith Mfg Co., Josam CO, Watts, Zurn
  2. Standard: ASME A112.36.2M. Include wall access.
  3. Size: Same as connected drainage piping.
  4. Body: No-hub, cast-iron soil pipe test tee as required to match connected piping.
  5. Closure Plug:
    - a. Cast iron.
    - 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.
  6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
  7. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.
- D. Test Tees:
1. JR Smith Mfg. CO, Josam CO, Watts, Zurn
  2. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301.
  3. Size: Same as connected drainage piping.
  4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
  5. Closure Plug: Countersunk or raised head, brass.
  6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

## **2.4 BACKWATER VALVES**

- A. Cast-Iron, Horizontal Backwater Valves:
1. JR Smith Mfg CO, Josam Co, Watts, Zurn
  2. Standard: ASME A112.14.1.
  3. Size: Same as connected piping.
  4. Body Material: Cast iron.
  5. Cover: Cast iron with bolted or threaded access check valve.
  6. End Connections: no hub.
  7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
  8. Extension: ASTM A74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
- B. Cast-Iron, Drain-Outlet Backwater Valves :
1. JR Smith, Josam, Watts, Zurn
  2. Standard: ASME A112.14.1.
  3. Size: Same as floor drain outlet.

4. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
5. Check Valve: Removable ball float.
6. Inlet: Threaded.
7. Outlet: Threaded or spigot.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof drains at low points of roof areas in accordance with roof membrane manufacturer's written installation instructions.
  1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  2. Install expansion joints, if indicated, in roof drain outlets.
  3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install downspout boots at grade with top 6 inches above grade. Secure to building wall.
- D. Install downspout nozzles at exposed bottom of conductors where they spill onto grade.
- E. Install cleanouts in aboveground piping and building drain piping in accordance with 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 storm piping conductor.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install horizontal backwater valves in floor with cover flush with floor.
- I. Install drain-outlet backwater valves in outlet of drains.
- J. Install test tees in vertical conductors and near floor.
- K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
- M. Assemble channel drainage system components in accordance with manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- N. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
  1. Comply with requirements in Section 078413 "Penetration Firestopping."

### **3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.3 INSTALLATION OF FLASHING

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.

### 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**

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**SECTION 223400**  
**FUEL-FIRED, DOMESTIC-WATER HEATERS**

**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. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
  - 2. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
  - 3. Domestic-water heater accessories.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. 50 Gallons, recovery GPH @100°F Delta T 138GPH, 120V/1ø, and furnished With Amtrol Model #st-5-c Expansion Tank and accessories.
- B. Sustainable Design Submittals:
  - 1. AO Smith basis of design.
- C. Shop Drawings:
  - 1. Include diagrams for power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
- B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.
- D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

**1.6 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: One year(s).
    - b.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

### 2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1. AO Smith Basis of design
  - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
  - 3. Standard: ANSI Z21.10.3/CSA 4.3.
  - 4. Storage-Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.
    - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
      - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
    - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Lining: Cement, Glass or Sheet copper complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed, Storage-Tank Appurtenances:
  - a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
  - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
  - e. Jacket: Steel with enameled finish.
  - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
  - g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
  - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Special Requirements: NSF 5 construction.
7. Draft Hood: Draft diverter, complying with ANSI Z21.12.
8. Automatic Damper: ANSI Z21.66/CSA 6.14, mechanically activated, automatic-vent-damper device with size matching draft hood.

### **2.3 DOMESTIC-WATER HEATER ACCESSORIES**

- A. Domestic-Water Expansion Tanks:
  1. Amtrol basis of design
  2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
  3. 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.
  4. 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 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  5. Capacity and Characteristics:
    - a. Working-Pressure Rating: 100 psig.
    - b. Capacity Acceptable: See Schedule minimum.
    - c. Air Precharge Pressure: pre charge pressure.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
  - 1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
- J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 6 inches above the floor.
- M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## **2.4 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 DOMESTIC-WATER HEATER INSTALLATION**

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
  - 2. Maintain manufacturer's recommended clearances.
  - 3. Arrange units so controls and devices that require servicing are accessible.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.
  8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters in accordance with NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
  4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping".
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- 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 domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water expansion tanks with air to required system pressure.
- L. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

### **3.2 PIPING CONNECTIONS**

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."
- C. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."
- D. Drawings indicate general arrangement of piping, fittings, and specialties.
- E. Where installing piping adjacent to fuel-fired, 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 220553 "Identification for Plumbing Piping and Equipment."

### **3.4 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

### **3.5 DEMONSTRATION**

- A. Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

**END OF SECTION**

**SECTION 224213.13**  
**COMMERCIAL WATER CLOSETS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Wall-mounted water closets.
  - 2. Flushometer valves.
  - 3. Toilet seats.
  - 4. Supports.

**1.3 DEFINITIONS**

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

**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 water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
  - 1. Kohler, American Standard, Zurn, Toto
- C. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

**1.6 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.

**PART 2 - PRODUCTS**

**2.1 WALL-MOUNTED WATER CLOSETS**

- A. Water Closets, Wall Mounted, Top Spud, Accessible:
  - 1. American Standard, Kohler, CO, Sloan, Zurn, Toto
  - 2. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 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.-1.6 gal. per flush.
  - h. Spud Size and Location: NPS 1-1/2; top.
- 3. Flushometer Valve: Sloan basis of design.
  - 4. Toilet Seat: Kohler basis of design.
  - 5. Support: Zurn.
  - 6. Water-Closet Mounting Height: Standard, Handicapped/elderly according to ICC/ANSI A117.1.
- B. Water Closets, Wall Mounted, Top Spud, Accessible:
- 1. American Standard, Kohler, Sloan, Toto, Zurn
  - 2. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 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. to 1.6 gal. per flush.
    - h. Spud Size and Location: NPS 1-1/2; back.
  - 3. Flushometer Valve: Sloan basis of design.
  - 4. Toilet Seat: Kohler basis of design.
  - 5. Support: Water closet carrier Zurn basis of design.
  - 6. Water-Closet Mounting Height: Standard and Handicapped/elderly according to ICC A117.1.

## 2.2 FLUSHOMETER VALVES

- A. Lever-Handle, Diaphragm Flushometer Valves:
- 1. Sloan, Kohler, Zurn
  - 2. Standard: ASSE 1037.
  - 3. Minimum Pressure Rating: 125 psig.
  - 4. Features: Include integral check stop and backflow-prevention device.
  - 5. Material: Brass body with corrosion-resistant components.
  - 6. Exposed Flushometer-Valve Finish: Chrome plated.
  - 7. Panel Finish: Chrome plated or stainless steel.
  - 8. Style: Exposed.
  - 9. Consumption: 1.28 gal. to 1.6 gal. per flush.
  - 10. Minimum Inlet: NPS 1.
  - 11. Minimum Outlet: NPS 1-1/4.
- B. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:
- 1. Sloan, Kohler, Zurn
  - 2. Standard: ASSE 1037.

3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. to 1.6 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

### **2.3 TOILET SEATS**

- A. Toilet Seats :
  1. Kohler basis of design
  2. Standard: IAPMO/ANSI Z124.5.
  3. Material: Plastic.
  4. Type: Commercial (Standard) and Commercial (Heavy duty).
  5. Shape: Elongated rim, open front.
  6. Hinge: Check.
  7. Hinge Material: Noncorroding metal.
  8. Seat Cover: Not required.
  9. Color: See Arch otherwise White.

### **2.4 SUPPORTS**

- A. Water Closet Carrier:
  1. Zurn basic of design
  2. Standard: ASME A112.6.1M.
  3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

## **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 water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. Water-Closet Installation:
  1. Install level and plumb according to roughing-in drawings.
  2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
1. 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. Flushometer-Valve Installation:
1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
  2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  3. Install lever-handle flushometer valves for accessible water closets 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.
- D. Install toilet seats on water closets.
- E. 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 220518 "Escutcheons for Plumbing Piping."
- F. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  2. Match sealant color to water-closet color.
  3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### **3.4 ADJUSTING**

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.5 CLEANING AND PROTECTION**

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 224213.16**  
**COMMERCIAL URINALS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Urinals.
  - 2. Flushometer valves.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 WALL-HUNG URINALS**

- A. Urinals P-3 & P-4: Wall hung, back outlet, washout, P-4 - accessible.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard.
    - b. Crane Plumbing, L.L.C.
    - c. Kohler Co.
    - d. TOTO USA, INC.
  - 2. Fixture:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: 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.
  - 3. Flushometer Valve: Manual with key, see schedule on drawing.
  - 4. Waste Fitting:
    - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
    - b. Size: NPS 2.
  - 5. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights..
  - 6. Urinal Mounting Height: P-3 – Standard; P-4 - Handicapped/elderly according to ICC A117.1.

## **2.2 URINAL FLUSHOMETER VALVES**

- A. Lever-Handle, Diaphragm Flushometer Valves, P-3 & P-4:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Sloan Valve Company.
  - 2. Standard: ASSE 1037.
  - 3. Minimum Pressure Rating: 125 psig.
  - 4. Features: Include integral check stop and backflow-prevention device.
  - 5. Material: Brass body with corrosion-resistant components.
  - 6. Exposed Flushometer-Valve Finish: Chrome plated.
  - 7. Style: Exposed.
  - 8. Consumption: 1.0 gal. per flush.
  - 9. Minimum Inlet: NPS 3/4.
  - 10. Minimum Outlet: NPS 1-1/4.

## **2.3 SUPPORTS**

- A. Type I Urinal Carrier:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. Wade Drains.
    - d. WATTS.
  - 2. Standard: ASME A112.6.1M.

## **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 urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. 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.
- B. 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.

- C. Flushometer-Valve Installation:
  - 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
  - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  - 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
  - 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to urinal color.
  - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

### **3.4 ADJUSTING**

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.5 CLEANING AND PROTECTION**

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 224216.13**  
**COMMERCIAL LAVATORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Lavatories.
  - 2. Faucets.
  - 3. Supports.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

**PART 2 - PRODUCTS**

**2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES**

- A. Lavatory, P-2: Vitreous china, wall mounted, with back.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. TOTO USA.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: For wall hanging.
    - c. Nominal Size: 20 by 19 inches.
    - d. Faucet-Hole Punching: One hole.
    - e. Faucet-Hole Location: Top.
    - f. Color: White.
    - g. Mounting Material: Chair carrier.
  - 3. Faucet: Sensor, see schedule on drawing .
  - 4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
  - 5. Lavatory Mounting Height: P-15 – Standard; P-5 - Handicapped/elderly according to ICC A117.1.

**2.2 SUPPORTS**

- A. Type II Lavatory Carrier:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.

- b. Josam Company.
  - c. Wade Drains.
  - d. WATTS.
2. Standard: ASME A112.6.1M.

### **2.3 SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

### **2.4 WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### **3.3 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.5 CLEANING AND PROTECTION**

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 224216.16  
COMMERCIAL SINKS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Service basins.
  - 2. Sink faucets.
  - 3. Supports.
  - 4. Supply fittings.
  - 5. Waste fittings.

**1.2 ACTION SUBMITTALS**

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

**1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance data.

**PART 2 - PRODUCTS**

**2.1 SERVICE BASINS**

- A. Service Basins, P-4: Terrazzo, floor mounted.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fiat.
    - b. Florestone
    - c. Stern Williams
  - 2. Fixture:
    - a. Standard: IAPMO/ANSI Z124.6.
    - b. Material: Terrazzo .
    - c. Nominal Size: 24 by 24 by 12 inches.
    - d. Tiling Flange: Not required.
    - e. Rim Guard: On front top surfaces.
    - f. Color: Not applicable.
    - g. Drain: Grid with NPS 3 outlet.
  - 3. Mounting: On floor and flush to wall.
  - 4. Faucet: See schedule on drawing .

**2.2 SINK FAUCETS**

- A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: See schedule on drawing.

**2.3 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/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

## **2.4 WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 2.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
  - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. 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 Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### **3.3 CONNECTIONS**

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

### **3.5 CLEANING AND PROTECTION**

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 224716**  
**PRESSURE WATER COOLERS**

**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 pressure water coolers and related components.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of pressure water cooler.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
  - 1. Elkay, Haws
- C. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

**1.5 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. Filter Cartridges: Equal to 100 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

**PART 2 - PRODUCTS**

**2.1 PRESSURE WATER COOLERS**

- A. Pressure Water Coolers P-7 Flush to wall.
  - 1. Elkay, Haws
  - 2. Standards:
    - a. Comply with NSF 61 and NSF 372.
    - b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
  - 3. Cabinet: Vinyl-covered steel with stainless-steel top.
  - 4. Bubbler: One, with adjustable stream regulator, located on deck.
  - 5. Control: Push button.
  - 6. Drain: Grid with NPS 1-1/4 tailpiece.
  - 7. Supply: NPS 3/8 with shutoff valve.
  - 8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
  - 9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.

10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    - 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.
  11. Capacities and Characteristics:
    - a. Cooled Water: 5 gph.
    - b. Ambient-Air Temperature: 90 deg F.
    - c. Inlet-Water Temperature: 80 deg F.
    - d. Cooled-Water Temperature: 50 deg F.
    - e. Electrical Characteristics:
      - 1) Motor Horsepower: 1/6.
      - 2) Volts: 120-V ac.
      - 3) Phase: Single.
      - 4) Hertz: 60.
      - 5) Full-Load Amperes: 5.
      - 6) Minimum Circuit Ampacity:
      - 7) Maximum Overcurrent Protection: .
- B. Pressure Water Coolers P-7: Wall mounted, standard, wheelchair accessible, bottle filler, vandal resistant.
1. Elkay, Haws
  2. Standards:
    - a. Comply with NSF 61 and NSF 372.
    - b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
    - c. Comply with ICC A117.1.
  3. Cabinet: Single vinyl-covered steel with stainless-steel top.
  4. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
  5. Control: Push button.
  6. Bottle Filler: Sensor activation with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm.
  7. Drain: Grid with NPS 1-1/4 tailpiece.
  8. Supply: NPS 3/8 with shutoff valve.
  9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
  10. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
  11. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    - 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.

12. Capacities and Characteristics:
  - a. Cooled Water: 5 gph.
  - b. Ambient-Air Temperature: 90 deg F.
  - c. Inlet-Water Temperature: 80 deg F.
  - d. Cooled-Water Temperature: 50 deg F.
  - e. Electrical Characteristics:
    - 1) Motor Horsepower: 1/6.
    - 2) Volts: 120-V ac.
    - 3) Phase: Single.
    - 4) Hertz: 60.
    - 5) Full-Load Amperes: 5.
    - 6) Minimum Circuit Ampacity: 5 amperage.
    - 7) Maximum Overcurrent Protection: 5 amperage.
13. Support: Type I Water Cooler Carrier.
14. Water Cooler Mounting Height: Handicapped/elderly according to ICC A117.

## **2.2 SUPPORTS**

- A. Type I Water Cooler Carrier:
  1. Zurn, Watts, JR Smith or Josam
  2. Standard: ASME A112.6.1M.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Set freestanding pressure water coolers on floor.
- C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and in-wall bottle filling stations to mounting frames.
- E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- G. 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 220518 "Escutcheons for Plumbing Piping."
- H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water-cooler temperature settings.

### **3.5 CLEANING**

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION**