Cleveland Clinic

Cleveland Clinic Master Specifications: Division 22 - Plumbing

This document contains the Master Specifications for the design and construction of new and renovated facilities for all domestic Cleveland Clinic locations. It is be used by A/E firms in the preparation of Construction Documents for all facility types.

The general purpose of each Specification is to provide minimum criteria for construction materials at Cleveland Clinic facilities regarding Code and FM Global compliance, warranty, approved products, execution and uniformity.

The Specifications are used to prepare specific project Contract Specifications. They are intended to be used to address system design aspects of equipment that Cleveland Clinic desires to standardize among facilities, and identify prohibited materials and construction practices. Use of these Specifications will help A/E’s meet the Cleveland Clinic’s primary goal of providing a safe, reliable, and energy efficient installations and ultimately successful patient outcomes.

The use of these Specifications is mandatory for all design or maintenance projects. Deviations are discouraged. If project conditions arise which require a deviation, it should be thoroughly documented by the user and submitted to the Cleveland Clinic for review and approval using the Design Standards Revision Request document. Additionally, all Cleveland Clinic staff, architects, engineers, and contractors are encouraged to participate in the ongoing development of these guidelines by communicating any suggestions by use of the Revision Request document.

USER NOTE: throughout the specifications, bracketed, bold text indicates optional requirements which may be deleted if project conditions permit.

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SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Separate winding for each speed.


F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron or extruded aluminum for motors greater than 1 hp; cast iron, extruded aluminum or rolled steel for motors 1 hp and smaller.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513
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. Flexible-hose packless expansion joints.
   2. Metal-bellows packless expansion joints.
   3. Rubber packless expansion joints.
   5. Pipe loops and swing connections.
   6. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

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

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.

2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.

3. Alignment Guide Details: Detail field assembly and attachment to building structure.

4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

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

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Metraflex, Inc.
   e. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.

3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

4. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.

   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.

6. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Stainless-steel fittings with threaded end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Stainless-steel fittings with flanged end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.

B. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Adsco Manufacturing LLC.
   b. American BOA, Inc.
   c. Badger Industries, Inc.
   d. Expansion Joint Systems, Inc.
   e. Flex-Hose Co., Inc.
   f. Flexicraft Industries.
   g. Flex Pression Ltd.
   h. Flex-Weld, Inc.
   i. Flo Fab inc.
   j. Hyspan Precision Products, Inc.
   k. Metraflex, Inc.
   l. Proco Products, Inc.
   m. Senior Flexonics Pathway.
   n. Tozen Corporation.
   o. Unaflex.
   p. Unisource Manufacturing, Inc.
   q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
   r. U.S. Bellows, Inc.
   s. WahlcoMetroflex.

3. Type: Circular, corrugated bellows with external tie rods.

4. Minimum Pressure Rating: [150 psig (1035 kPa)] [175 psig (1200 kPa)] unless otherwise indicated.

5. Configuration: [Single joint] [Single joint with base] [and] [double joint with base] class(es) unless otherwise indicated.

6. Expansion Joints for Copper Tubing: [Single] [Single- or multi] [Multi]-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
   a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: [Solder joint] [or] [threaded].
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [Solder joint] [or] [threaded].
   c. End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.

C. Rubber Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
   b. Flex-Hose Co., Inc.
   c. Flexicraft Industries.
   d. Flex-Weld, Inc.
   e. Garlock Sealing Technologies.
   f. General Rubber Corporation.
   g. Mason Industries, Inc.; Mercer Rubber Co.
   h. Metraflex, Inc.
   i. Proco Products, Inc.
   j. Red Valve Company, Inc.
   k. Tozen Corporation.
   l. Unaflex.
   m. Unisource Manufacturing, Inc.


4. Arch Type: [Single] [or] [multiple] arches with external control rods.

5. Spherical Type: [Single] [or] [multiple] spheres with external control rods.

6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).

7. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).

8. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).

9. Material for Fluids Containing Acids, Alkalies, or Chemicals: [BR] [CSM] [EPDM].

10. Material for Fluids Containing Gas, Hydrocarbons, or Oil: [Buna-N] [CR].

11. Material for Water: [BR] [Buna-N] [CR] [CSM] [EPDM] [NR].

2.2 GROOVED-JOINT EXPANSION JOINTS

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

1. Anvil International, Inc.
2. Shurjoint Piping Products.
3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.


E. Couplings: [Five] [Seven] [10] [12], flexible type for steel-pipe dimensions. Include ferrous housing sections, [Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water] [EPDM gasket suitable for cold and hot water], and bolts and nuts.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

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

a. Adsco Manufacturing LLC.
b. Advanced Thermal Systems, Inc.
c. Flex-Hose Co., Inc.
d. Flexicraft Industries.
e. Flex-Weld, Inc.
f. Hyspan Precision Products, Inc.
g. Metraflex, Inc.
h. Senior Flexonics Pathway.
i. Unisource Manufacturing, Inc.
j. U.S. Bellows, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION
   A. Install expansion joints of sizes matching sizes of piping in which they are installed.
   B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
   C. Install rubber packless expansion joints according to FSA-NMEJ-702.
   D. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION
   A. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
   B. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
   C. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION
   A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
   2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
   3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
   1. Anchor Attachment to Steel Structural Members: Attach by welding.
   2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516
SECTION 220517 - SLEEVES AND SLEEVE SEALS 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. Sleeves.
      2. Stack-sleeve fittings.
      3. Sleeve-seal systems.
      4. Sleeve-seal fittings.
      5. Grout.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES
   A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron
      pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
   B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded
      steel collar; zinc coated.
   C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc
      coated, with plain ends.
   D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed
      with welded longitudinal joint.
   E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with
      nailing flange for attaching to wooden forms.
2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, Inc.
   2. CALPICO, Inc.
   3. Metraflex Company (The).
   4. Pipeline Seal and Insulator, Inc.
   5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: [EPDM-rubber] [NBR] interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
   3. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
   2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than [NPS 6 (DN 150)]: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] [Sleeve-seal fittings].
   b. Piping NPS 6 (DN 150) and Larger: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves].

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller than NPS 6 (DN 150): [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Sleeve-seal fittings].
[Retain first subparagraph below if using sleeve-seal systems; delete if using sleeve-seal fittings.]

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping **NPS 6 (DN 150)** and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system].

[Retain first subparagraph below if using sleeve-seal systems; delete if using sleeve-seal fittings.]

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller than **NPS 6 (DN 150)**: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Sleeve-seal fittings].

[Retain first subparagraph below if using sleeve-seal systems; delete if using sleeve-seal fittings.]

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping **NPS 6 (DN 150)** and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves].

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than **NPS 6 (DN 150)**: [Galvanized-steel-pipe sleeves] [Stack-sleeve fittings] [Sleeve-seal fittings] [Molded-PE or -PP sleeves].

b. Piping **NPS 6 (DN 150)** and Larger: [Galvanized-steel-pipe sleeves] [Stack-sleeve fittings].

5. Interior Partitions:

a. Piping Smaller Than **NPS 6 (DN 150)**: Galvanized-steel-pipe sleeves.


**END OF SECTION 220517**
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. Escutcheons.
      2. Floor plates.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS
   A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
   B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and
      spring-clip fasteners.
   C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
   D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and
      setscrew.
   E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, [concealed] [and] [exposed-
      rivet] hinge, and spring-clip fasteners.

2.2 FLOOR PLATES
   A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
   B. Split-Casting Floor Plates: Cast brass with concealed hinge.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass\text{ or split-casting brass} type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type\text{ or split-plate, stamped-steel type with concealed hinge} \text{ or split-plate, stamped-steel type with exposed-rivet hinge}.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass\text{ or split-casting brass} type with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass\text{ or split-casting brass} type with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass\text{ or split-casting brass} type with polished, chrome-plated finish.
   g. Bare Piping in Equipment Rooms: One-piece, cast-brass\text{ or split-casting brass} type with polished, chrome-plated finish.

2. Escutcheons for Existing Piping:
   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with \text{concealed} \text{ or} \text{ exposed-rivet} hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.
3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518
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. Filled-system thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

B. Related Sections:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Section 211200 "Fire-Suppression Standpipes" for fire protection pressure gages.
3. Section 211313 "Wet-Pipe Sprinkler Systems"
4. Section 211316 "Dry-Pipe Sprinkler Systems" for fire protection pressure gages.
5. Section 211339 "Foam-Water Systems" for fire protection pressure gages.
6. Section 221113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
7. Section 221116 "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.
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 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Ashcroft Inc.
b. Marsh Bellofram.
c. Trerice, H. O. Co.
d. Weiss Instruments, Inc.

3. Case: Sealed type, cast aluminum or drawn steel 6-inch (152-mm) nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
8. Window: Glass.
9. Ring: [Metal] [Stainless steel].
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
   
a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Ashcroft Inc.
b. Marsh Bellofram.
c. Trerice, H. O. Co.
d. Weiss Instruments, Inc.

3. Case: Sealed type, cast aluminum or drawn steel 6-inch (152-mm) nominal diameter with [back] [front] flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
8. Window: Glass.
9. Ring: [Metal] [Stainless steel].
10. Connector Type(s): Union joint, [back] [bottom]; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:
   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] [CSA].
   5. Type: Stepped shank unless straight or tapered shank is indicated.
   6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
   7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), 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].

2.3 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. Marsh Bellofram.
      c. Noshok.
      d. Trerice, H. O. Co.
b. **Weiss Instruments, Inc.**

e.  


3. Case: [Liquid-filled] [Sealed] [Open-front, pressure relief] [Solid-front, pressure relief] type(s); [cast aluminum or drawn steel]; [4-1/2-inch (114-mm)] [6-inch (152-mm)] nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)]. 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 and kPa.


10. Ring: [Metal] [Brass] [Stainless steel].

11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

**B. Remote-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. **Marsh Bellofram.**

   c. **Noshok.**

   d. **Trerice, H. O. Co.**

   e. **Weiss Instruments, Inc.**


3. Case: [Liquid-filled] [Sealed] type; [cast aluminum or drawn steel] [metal]; [4-1/2-inch (114-mm)] [6-inch (152-mm)] nominal diameter with [back] [front] flange and holes for panel mounting.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.  
[Match pressure connection size in first subparagraph below with gage attachment size.]

5. Pressure Connection: Brass, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)]. 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 and kPa.


10. Ring: [Metal] [Stainless steel].

11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
2.4 GAGE ATTACHMENTS

[Match attachment size in two paragraphs below with pressure-gage-connection size.]

A. Snubbers: ASME B40.100, brass; with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads and [piston] [porous-metal]-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with [NPS 1/4 (DN 8)] [NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

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

1. Flow Design, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: [NPS 1/4 (DN 8)] [or] [NPS 1/2 (DN 15)], ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: Chlorosulfonated polyethylene synthetic] [and] [EPDM] self-sealing rubber.

2.6 TEST-PLUG KITS

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

1. Flow Design, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish two test-plug kit(s) containing [one] [two] thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.7 SIGHT FLOW INDICATORS

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

1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
4. Ernst Co., John C., Inc.
5. Ernst Flow Industries.
6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
7. OPW Engineered Systems; a Dover company.
8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and [ball, flapper, or paddle wheel] indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 150 psig (1034 kPa).

E. Minimum Temperature Rating: 200 deg F (93 deg C).

F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.
3.1 INSTALLATION

A. Install thermowells with socket extending [a minimum of 2 inches (51 mm) into fluid] [one-third of pipe diameter] [to center of pipe] and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install 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 test plugs in piping tees.

K. 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.

L. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.
3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
   1. [Direct] [Remote]-mounted, metal-case, vapor-actuated type.
   2. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
   1. [Direct] [Remote]-mounted, metal-case, vapor-actuated type.
   2. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
   1. [Direct] [Remote]-mounted, metal-case, vapor-actuated type.
   2. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

D. Thermometers at inlet and outlet of each remote domestic water chiller shall be the following:
   1. [Direct] [Remote]-mounted, metal-case, vapor-actuated type.
   2. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

E. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: [0 to 100 deg F and minus 20 to plus 50 deg C].

B. Scale Range for Domestic Hot-Water Piping: [30 to 240 deg F and 0 to plus 115 deg C].

C. Scale Range for Domestic Cooled-Water Piping: [0 to 100 deg F and minus 20 to plus 50 deg C].

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be [one of] the following:
   1. [Liquid-filled] [Sealed] [Open-front, pressure-relief] [Solid-front, pressure-relief], [direct] [remote]-mounted, metal case.
   2. [Sealed], [direct] [remote]-mounted, plastic case.
   3. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.
B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be [one of] the following:

1. [Liquid-filled] [Sealed] [Open-front, pressure-relief] [Solid-front, pressure-relief], [direct] [remote]-mounted, metal case.
2. [Sealed], [direct] [remote]-mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be [one of] the following:

1. [Liquid-filled] [Sealed] [Open-front, pressure-relief] [Solid-front, pressure-relief], [direct] [remote]-mounted, metal case.
2. [Sealed], [direct] [remote]-mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: [0 to 100 psi (0 to 600 kPa)] [0 to 100 psi and 0 to 600 kPa].

B. Scale Range for Water Service Piping: [0 to 160 psi (0 to 1100 kPa)] [0 to 160 psi and 0 to 1100 kPa].

C. Scale Range for Water Service Piping: [0 to 200 psi (0 to 1400 kPa)] [0 to 200 psi and 0 to 1400 kPa].

D. Scale Range for Domestic Water Piping: [0 to 100 psi (0 to 600 kPa)] [0 to 100 psi and 0 to 600 kPa].

E. Scale Range for Domestic Water Piping: [0 to 160 psi (0 to 1100 kPa)] [0 to 160 psi and 0 to 1100 kPa].

F. Scale Range for Domestic Water Piping: [0 to 200 psi (0 to 1400 kPa)] [0 to 200 psi and 0 to 1400 kPa].

G. Scale Range for Domestic Water Piping: [0 to 300 psi (0 to 2500 kPa)] [0 to 300 psi and 0 to 2500 kPa].

END OF SECTION 220519
SECTION 220523 - GENERAL-DUTY VALVES 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. Brass ball valves.
      2. Bronze ball valves.
      5. Bronze lift check valves.
      8. Iron, grooved-end swing check valves.
     11. Chainwheels.

   B. Related Sections:

      1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
      2. Section 221113 "Facility Water Distribution Piping" for valves applicable only to this piping.
      3. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
      4. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
      5. Section 221423 "Storm Drainage Piping Specialties" for valves applicable only to this piping.
      6. Section 221513 "General-Service Compressed-Air Piping" for valves applicable only to this piping.
      7. Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" for valves applicable only to this piping.
      8. Section 226213 "Vacuum Piping for Laboratory and Healthcare Facilities" for valves applicable only to this piping.
      9. Section 226313 "Gas Piping for Laboratory and Healthcare Facilities" for valves applicable only to this piping.
     10. Section 334100 "Storm Utility Drainage Piping" for valves applicable only to this piping.
     11. Section 334600 "Subdrainage" for valves applicable only to this piping.
1.3 DEFINITIONS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Nonrising stem.
E. OS&Y: Outside screw and yoke.
F. RS: Rising stem.
G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.
   3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valves shall be American made.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
   4. Wrench: For plug valves with square heads. Furnish Cleveland Clinic with 1 wrench for every [5] [10] plug valves, for each size square plug-valve head.
   5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

F. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
   1. Gate Valves: With rising stem.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

G. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Grooved: With grooves according to AWWA C606.
   4. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. [Hammond Valve](#).
   b. [Milwaukee Valve Company](#).
   c. [Mueller](#).
   d. [Watts](#).
   e. [Conbraco Industries, Inc.; Apollo Valves](#).

2. **Description**:
   a. **Standard**: MSS SP-110.
   b. **SWP Rating**: 150 psig (1035 kPa).
   c. **CWP Rating**: 600 psig (4140 kPa).
   d. **Body Design**: Two piece.
   e. **Body Material**: Forged brass.
   f. **Ends**: Threaded.
   g. **Seats**: PTFE or TFE.
   h. **Stem**: Brass.
   i. **Ball**: Chrome-plated brass.
   j. **Port**: Full.

B. **Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim**:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. [Hammond Valve](#).
   b. [Milwaukee Valve Company](#).
   c. [Mueller](#).
   d. [Watts](#).
   e. [Conbraco Industries, Inc.; Apollo Valves](#).

2. **Description**:
   a. **Standard**: MSS SP-110.
   b. **SWP Rating**: 150 psig (1035 kPa).
   c. **CWP Rating**: 600 psig (4140 kPa).
   d. **Body Design**: Two piece.
   e. **Body Material**: Forged brass.
   f. **Ends**: Threaded.
   g. **Seats**: PTFE or TFE.
   h. **Stem**: Stainless steel.
   i. **Ball**: Stainless steel, vented.
   j. **Port**: Full.

C. **Three-Piece, Full-Port, Brass Ball Valves with Brass Trim**:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. [Watts Regulator Co.; a division of Watts Water Technologies, Inc.](#).
b. **Conbraco Industries, Inc.; Apollo Valves.**

2. **Description:**
   
   a. **Standard:** MSS SP-110.
   
   b. **SWP Rating:** 150 psig (1035 kPa).
   
   c. **CWP Rating:** 600 psig (4140 kPa).
   
   d. **Body Design:** Three piece.
   
   e. **Body Material:** Forged brass.
   
   f. **Ends:** Threaded.
   
   g. **Seats:** PTFE or TFE.
   
   h. **Stem:** Brass.
   
   i. **Ball:** Chrome-plated brass.
   
   j. **Port:** Full.

D. **Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:**

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
   a. **Mueller.**
   
   b. **Watts Regulator Co.; a division of Watts Water Technologies, Inc.**
   
   c. **Conbraco Industries, Inc.; Apollo Valves.**

2. **Description:**

   a. **Standard:** MSS SP-110.
   
   b. **SWP Rating:** 150 psig (1035 kPa).
   
   c. **CWP Rating:** 600 psig (4140 kPa).
   
   d. **Body Design:** Three piece.
   
   e. **Body Material:** Forged brass.
   
   f. **Ends:** Threaded.
   
   g. **Seats:** PTFE or TFE.
   
   h. **Stem:** Stainless steel.
   
   i. **Ball:** Stainless steel, vented.
   
   j. **Port:** Full.

2.3 **BRONZE BALL VALVES**

A. **Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:**

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

   a. **American Valve, Inc.**
   
   b. **Conbraco Industries, Inc.; Apollo Valves.**
   
   c. **Hammond Valve.**
   
   d. **Milwaukee Valve Company.**
   
   e. **Watts Regulator Co.; a division of Watts Water Technologies, Inc.**

2. **Description:**
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Red-White Valve Corporation.

2. Description:
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Three piece.
   e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
a. [Conbraco Industries, Inc.; Apollo Valves](#).
b. [Hammond Valve](#).
c. [Milwaukee Valve Company](#).

2. Description:
   
b. SWP Rating: **150 psig** (**1035 kPa**).
c. CWP Rating: **600 psig** (**4140 kPa**).
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum Bronze Disc:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
a. [Conbraco Industries, Inc.; Apollo Valves](#).
b. [Crane Co.; Crane Valve Group; Center Line](#).
c. [Crane Co.; Crane Valve Group; Stockham Division](#).
d. [DeZurik Water Controls](#).
e. [Hammond Valve](#).
f. [Milwaukee Valve Company](#).
g. [Mueller Steam Specialty; a division of SPX Corporation](#).
h. [Watts Regulator Co.; a division of Watts Water Technologies, Inc.](#).

2. Description:
   
a. Standard: MSS SP-67, Type I, API 609.
b. CWP Rating: **200 psig** (**1380 kPa**).
c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2” through 12” without use of downstream flange. Field replaceable hard phenolic backed liner.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece 416 stainless steel.
g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Co.; Crane Valve Group; Center Line.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. DeZurik Water Controls.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. Mueller Steam Specialty; a division of SPX Corporation.
   h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. **Description**:
   a. Standard: MSS SP-67, Type I, API 609.
   b. CWP Rating: **200 psig (1380 kPa)**.
   c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2” through 12” without use of downstream flange. Field replaceable hard phenolic backed liner.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: NBR.
   f. Stem: One- or two-piece 416 stainless steel.
   g. Disc: Nickel-plated or coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. DeZurik Water Controls.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. Mueller Steam Specialty; a division of SPX Corporation.
   h. Red-White Valve Corporation.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. **Description**:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: **200 psig (1380 kPa)**.
   c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2” through 12” without use of downstream flange. Field replaceable hard phenolic backed liner.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. DeZurik Water Controls.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. Mueller Steam Specialty; a division of SPX Corporation.
   h. Red-White Valve Corporation.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Lug type; suitable for bidirectional double dead-end service at full rated pressure 2” through 12” without use of downstream flange. Field replaceable hard phenolic backed cartridge.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: NBR.
   f. Stem: One- or two-piece 416 stainless steel.
   g. Disc: Stainless steel.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kennedy Valve; a division of McWane, Inc.
   b. Shurjoint Piping Products.
   c. Tyco Fire Products LP; Grinnell Mechanical Products.
   d. Victaulic Company.
   e. Conbraco Industries, Inc.; Apollo Valves.

2. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 175 psig (1200 kPa).
   c. Body Material: Coated, ductile iron.
B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
   a. [Anvil International, Inc.](#)
   b. [Kennedy Valve; a division of McWane, Inc.](#)
   c. [Mueller Steam Specialty; a division of SPX Corporation](#)
   d. [Shurjoint Piping Products](#)
   e. [Tyco Fire Products LP; Grinnell Mechanical Products](#)
   f. [Veitaulic Company](#)
   g. [Conbraco Industries, Inc.; Apollo Valves](#)

2. **Description:**
   
   a. Standard: MSS SP-67, Type I.
   b. NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
   c. NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
   d. Body Material: Coated, ductile iron.
   e. Stem: Two-piece stainless steel.
   f. Disc: Coated, ductile iron.
   g. Seal: EPDM.

2.6 **BRONZE LIFT CHECK VALVES**

A. Class 125, Lift Check Valves with Bronze Disc:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
   a. [Crane Co.; Crane Valve Group; Crane Valves](#)
   b. [Crane Co.; Crane Valve Group; Jenkins Valves](#)
   c. [Crane Co.; Crane Valve Group; Stockham Division](#)
   d. [Conbraco Industries, Inc.; Apollo Valves](#)

2. **Description:**
   
   a. Standard: MSS SP-80, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flo Fab Inc.
   b. Hammond Valve.
   c. Kitz Corporation.
   d. Milwaukee Valve Company.
   e. Mueller Steam Specialty; a division of SPX Corporation.
   f. Red-White Valve Corporation.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Conbraco Industries, Inc.; Apollo Valves.

2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   e. Ends: Threaded.
   f. Disc: NBR, PTFE, or TFE.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. Red-White Valve Corporation.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Conbraco Industries, Inc.; Apollo Valves

2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 300 psig (2070 kPa).
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Hammond Valve.
      e. Legend Valve.
      f. Milwaukee Valve Company.
      g. Red-White Valve Corporation.
      h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      i. Conbraco Industries, Inc.; Apollo Valves.

2. Description:
   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged.
   f. Trim: Bronze.
   g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Division.
      c. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged.
   f. Trim: Composition.
   g. Seat Ring: Bronze.
   h. Disc Holder: Bronze.
   i. Disc: PTFE or TFE.
   j. Gasket: Asbestos free.

2.9 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International, Inc.
      b. Shurjoint Piping Products.
      c. Tyco Fire Products LP; Grinnell Mechanical Products.
      d. Victaulic Company.

    2. Description:
       a. CWP Rating: 300 psig (2070 kPa).
       c. Seal: EPDM.
       d. Disc: Spring-operated, ductile iron or stainless steel.

2.10 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
      d. Crane Co.; Crane Valve Group; Stockham Division.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. Red-White Valve Corporation.
      h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      i. Conbraco Industries, Inc.; Apollo Valves.
2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   d. Ends: Threaded [or solder joint].
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Hammond Valve.
      e. Milwaukee Valve Company.
      f. Powell Valves.
      g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      h. Conbraco Industries, Inc.; Apollo Valves.

   2. Description:
      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 200 psig (1380 kPa).
      d. Ends: Threaded [or solder joint].
      e. Stem: Bronze.
      f. Disc: Solid wedge; bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, NRS Bronze Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hammond Valve.
      b. Milwaukee Valve Company.
      c. Red-White Valve Corporation.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Conbraco Industries, Inc.; Apollo Valves.

   2. Description:
      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 300 psig (2070 kPa).
D. Class 150, RS Bronze Gate Valves:

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

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. **Description**:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig (2070 kPa).
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

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

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. Red-White Valve Corporation.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   g. Conbraco Industries, Inc.; Apollo Valves.

2. **Description**:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron[, bronze, or aluminum].

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Red-White Valve Corporation.
   d. Conbraco Industries, Inc.; Apollo Valves.

2. **Description**:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   d. Ends: Threaded[ or solder joint].
   e. Stem: Bronze.
   f. Disc: PTFE or TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron[, bronze, or aluminum].

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Red-White Valve Corporation.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. **Description**:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 300 psig (2070 kPa).
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: PTFE or TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron[, bronze, or aluminum].
2.12 CHAINWHEELS

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

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to [ball] [butterfly] [and] [plug] valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.
E. Install chainwheels on operators for [ball] [butterfly] [gate] [and] [globe] valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball, butterfly, or gate valves.
   3. Throttling Service: Ball with memory stop, circuit setter, or flow control valves.
   4. Pump-Discharge Check Valves:
      a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with [bronze] [or] [nonmetallic] disc.
      b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Brass swing check valves with lever and weight or with spring or iron, center-guided, [metal] [or] [resilient]-seat check valves.
      c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
   4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
   5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
   7. For Grooved-End [Copper Tubing] [and] [Steel Piping]: Valve ends may be grooved.
3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze [and Brass] Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: [Two] [Three] piece, full port, [brass] [or] [bronze] with [brass] [bronze] [stainless-steel] trim.
   3. Bronze Lift Check Valves: Class 125, [bronze] [nonmetallic] disc.
   4. Bronze Swing Check Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
   5. Bronze Gate Valves: [Class 125] [Class 150], [NRS] [RS].

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
   3. Iron, Grooved-End Butterfly Valves: [175] [300] CWP.
   4. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
   5. Iron, Grooved-End Swing Check Valves: 300 CWP.

3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa))

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze [and Brass] Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: [Two] [Three] piece, full port, [brass] [or] [bronze] with [brass] [bronze] [stainless-steel] trim.
   3. Bronze Lift Check Valves: Class 125, [bronze] [nonmetallic] disc.
   4. Bronze Swing Check Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
   5. Bronze Gate Valves: [Class 125] [Class 150], [NRS] [RS].

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
   3. Iron, Grooved-End Butterfly Valves: [175] [300] CWP.
   4. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
   5. Iron, Grooved-End Swing Check Valves: 300 CWP.
3.7 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 4 (DN 100) and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Bronze Angle Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
   3. Ball Valves: [Two] [Three] piece, full port, bronze with brass trim.
   4. Bronze Swing Check Valves: [Class 125], [bronze] [nonmetallic] disc.
   5. Bronze Globe Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.

B. Pipe NPS 6 (DN 150) and Larger:
   2. Iron, Grooved-End Butterfly Valves: 300 CWP.
   3. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
   4. Iron, Grooved-End Swing Check Valves: 300 CWP.

3.8 [SANITARY-WASTE] [AND] [STORM-DRAINAGE] VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Bronze Angle Valves: [Class 125] [Class 150], [bronze] [nonmetallic] [stainless-steel] disc.
   3. Ball Valves: [Two] [Three] piece, full port, [brass] [or] [bronze] with [brass] [bronze] [stainless-steel] trim.
   4. Bronze Swing Check Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.
   5. Bronze Gate Valves: [Class 125] [Class 150], [NRS] [RS].
   6. Bronze Globe Valves: [Class 125] [Class 150], [bronze] [nonmetallic] disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
   2. Iron Swing Check Valves: [Class 125] [Class 250], [metal] [nonmetallic-to-metal] seats.
   3. Iron, Grooved-End Swing Check Valves: 300 CWP.

END OF SECTION 220523
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections:

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" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment [and obtain approval from authorities having jurisdiction].

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: [Signed and sealed by a qualified professional engineer.] Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Metal framing systems.
   3. Fiberglass strut systems.
   4. Pipe stands.
   5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of trapeze hangers.
   2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of [carbon steel] [stainless 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.

C. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [copper-coated steel] [stainless steel].

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:
   1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
   2. Hanger Rods: Continuous-thread rod, washer, and nuts made of [fiberglass] [polyurethane] [or] [stainless steel].

B. Strap-Type, Fiberglass Pipe Hangers:
   1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Powerstrut
   d. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of [carbon steel] [stainless steel].

   [Retain one of four subparagraphs below for coating.]

7. Metallic Coating: [Electroplated zinc] [Hot-dipped galvanized] [Mill galvanized] [In-line, hot galvanized] [Mechanically-deposited zinc].
8. Paint Coating: [Vinyl] [Vinyl alkyd] [Epoxy] [Polyester] [Acrylic] [Amine] [Alkyd].
9. Plastic Coating: [PVC] [Polyurethane] [Epoxy] [Polyester].
10. Combination Coating: <Insert coating materials in order of application>.

2.5 FIBERGLASS STRUT SYSTEMS

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

1. Allied Tube & Conduit.
2. Champion Fiberglass, Inc.
3. Cooper B-Line, Inc.
4. SEASAFE, INC.; a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass[ or other plastic] channel with inturned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of [fiberglass] [stainless steel].
2.6 THERMAL-HANGER SHIELD INSERTS

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

1. Carpenter & Paterson, Inc.
3. ERICO International Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: [ASTM C 552, Type II cellular glass with 100-psig (688-kPa)] [or] [ASTM C 591, Type VI, Grade I polyisocyanurate with 125-psig (862-kPa)] minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa)] [or] [ASTM C 552, Type II cellular glass with 100-psig (688-kPa)] [or] [ASTM C 591, Type VI, Grade I polyisocyanurate with 125-psig (862-kPa)] minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
C. Low-Type, Single-Pipe Stand: One-piece [plastic] [stainless-steel] base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:
   1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   2. Base: [Plastic] [Stainless steel].
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:
   1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   2. Bases: One or more; plastic.
   3. Vertical Members: Two or more protective-coated-steel channels.
   4. Horizontal Member: Protective-coated-steel channel.
   5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 PIPE POSITIONING SYSTEMS

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

2.10 EQUIPMENT SUPPORTS

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

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.


L. 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.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. 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 (DN 65) 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.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. 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.

Q. 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 (DN 100) 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 (DN 100) and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.

e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in [Section 099113 "Exterior Painting."],[Section 099123 "Interior Painting."],[Section 099600 "High-Performance Coatings."]

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel [pipe hangers and supports][metal trapeze pipe hangers][metal framing systems] and attachments for general service applications.

F. Use [stainless-steel pipe hangers][and][fiberglass pipe hangers][and][fiberglass strut systems] and [stainless-steel][or][corrosion-resistant] attachments for hostile environment applications.

G. Use copper-plated pipe hangers and [copper][or][stainless-steel] attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 (DN 20 to DN 200).

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 10 to DN 80).

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

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 (DN 100 to DN 900), 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 (DN 100 to DN 900), 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 (DN 65 to DN 900) 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 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) 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-joist 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 (340 kg).
   b. Medium (MSS Type 32): 1500 lb (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
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 (32 mm).
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-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.
END OF SECTION 220529
SECTION 220533 - HEAT TRACING 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 plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

2. Self-regulating, parallel resistance.
3. Constant wattage.

B. Related Requirements:

1. Section 210533 "Heat Tracing for Fire-Suppression Piping."
2. Section 230533 "Heat Tracing for HVAC Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.
1.5  CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6  WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1  PLASTIC-INSULATED, SERIES-RESISTANCE HEATING CABLES

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

1. Delta-Therm Corporation.
2. Raychem; a brand of Tyco Thermal Controls LLC.
3. Watts Radiant, Inc.; a subsidiary of Watts Water Technologies, Inc.

B. Comply with IEEE 515.1.

C. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled, nonheating leads with connectors at both ends.

D. Electrical Insulating Jacket: Minimum 4.0-mil (0.10-mm) Kapton with silicone, Tefzel, or polyolefin.

E. Cable Cover: Aluminum braid[ and silicone or Hylar outer jacket].

F. Maximum Operating Temperature (Power On): 300 deg F (150 deg C).

G. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).

H. 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.

I. Capacities and Characteristics:

1. Maximum Heat Output: [6 W/ft. (19.7 W/m)] [7.5 W/ft. (24.6 W/m)].
2. Piping Diameter: <Insert NPS (DN)>.  
3. Number of Parallel Cables: <Insert number>.  
4. Spiral Wrap Pitch: <Insert inches (mm)>.  
5. Electrical Characteristics for Single-Circuit Connection:
2.2 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chromalox.
   2. Delta-Therm Corporation.
   3. Raychem; a brand of Tyco Thermal Controls LLC.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel [No. 16] [No. 18] AWG, [tinned] [nickel-coated], stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: [Tinned-copper] [Stainless-steel] braid[ and polyolefin outer jacket with ultraviolet inhibitor].

F. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).

G. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).

H. 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.

I. Capacities and Characteristics:

   1. Maximum Heat Output: [3 W/ft. (9.8 W/m)] [5 W/ft. (16.4 W/m)] [8 W/ft. (26 W/m)] [10 W/ft. (32.8 W/m)] [12 W/ft. (39.4 W/m)].
   2. Piping Diameter: <Insert NPS (DN)>.
   3. Number of Parallel Cables: <Insert number>.
   4. Spiral Wrap Pitch: <Insert inches (mm)>.
   5. Electrical Characteristics for Single-Circuit Connection:

      a. Volts: [120] [208] [240] [277] [480].
      b. Phase: <Insert value>.
      c. Hertz: 60.
      d. Full-Load Amperes: <Insert value>.
      e. Minimum Circuit Ampacity: <Insert value>.
2.3 CONSTANT-WATTAGE HEATING CABLES

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

1. Chromalox.
2. Delta-Therm Corporation.
3. Raychem: a brand of Tyco Thermal Controls LLC.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 12 AWG, [tinned] [nickel-coated], stranded copper bus wires with single-stranded resistor wire connected between bus wires. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight.

D. Electrical Insulating Jacket: Flame-retardant fluoropolymer.

E. Cable Cover: [Tinned-copper] [Stainless-steel] braid[ and polyolefin outer jacket with ultraviolet inhibitor].

F. Maximum Operating Temperature (Power On): 392 deg F (200 deg C).

G. Maximum Exposure Temperature (Power Off): 185 deg F (85 deg C).

H. 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.

I. Capacities and Characteristics:


2. Electrical Characteristics for Single-Circuit Connection:

   a. Volts: [120] [208] [240] [277] [480].
   b. Phase: <Insert value>.
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert amperage>.

2.4 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F (minus 1 to plus 10 deg C).
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

B. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:

2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:
   a. Temperature Span: **34 to 44 deg F (1 to 7 deg C)**.
   b. Adjustable Delay-Off Span: 30 to 90 minutes.
   c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
4. Minimum 30-A contactor to energize cable or close other contactors.
5. Precipitation sensor shall be freestanding.
6. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control-system workstation.

C. Programmable Timer for Domestic Hot-Water-Temperature Maintenance:

1. Microprocessor based.
2. Minimum of four separate schedules.
3. Minimum 24-hour battery carryover.
4. On-off-auto switch.
5. 365-day calendar with 20 programmable holidays.
6. Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control-system workstation.

2.5 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least **3 mils (0.08 mm)** thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): **3/4 inch (19 mm)** minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: **1-1/2 inches (38 mm)** minimum.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

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

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: [Plastic-insulated, series-resistance] [Self-regulating, parallel-resistance] [Constant-wattage] heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

E. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

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

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Cleveland Clinic will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Isolation pads.
   2. Isolation mounts.
   3. Restrained elastomeric isolation mounts.
   4. [Freestanding] [ Restrained] [Freestanding and restrained] spring isolators.
   5. Housed spring mounts.
   6. Elastomeric hangers.
   7. Spring hangers.
   8. Spring hangers with vertical-limit stops.
   9. Pipe riser resilient supports.
  10. Resilient pipe guides.
  11. Seismic snubbers.
  12. Restraining braces and cables.
  13. [Steel] [Inertia] [Steel and inertia], vibration isolation equipment bases.

1.3 DEFINITIONS

   C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: [A] [B] [C] [D] [E] [F].
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: [I] [II] [III].
      a. Component Importance Factor: [1.0] [1.5].
      b. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0].
c. Component Amplification Factor: [1.0] [2.5].

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): <Insert percent>.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
   2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
   3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
   4. Seismic-Restraint Details:
      a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
      c. Preapproval and Evaluation Documentation: By [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having
jurisdiction], showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For [professional engineer] [and] [testing agency].

C. Welding certificates.

D. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
4. Isolation Technology, Inc.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.

C. Pads <Insert drawing designation>: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant [neoprene] [rubber] [hermetically sealed compressed fiberglass].

D. Mounts <Insert drawing designation>: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Mounts <Insert drawing designation>: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

F. Spring Isolators <Insert drawing designation>: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

G. Restrained Spring Isolators <Insert drawing designation>: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

H. Housed Spring Mounts <Insert drawing designation>: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

I. Elastomeric Hangers <Insert drawing designation>: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

J. Spring Hangers <Insert drawing designation>: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
K. Spring Hangers with Vertical-Limit Stop <Insert drawing designation>: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

L. Pipe Riser Resilient Support <Insert drawing designation>: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

M. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

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

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
5. Mason Industries.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.
C. **Steel Base** <Insert drawing designation>: Factory-fabricated, welded, structural-steel bases and rails.

1. **Design Requirements**: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   
   a. Include supports for suction and discharge elbows for pumps.

2. **Structural Steel**: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3. **Support Brackets**: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. **Inertia Base** <Insert drawing designation>: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. **Design Requirements**: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   
   a. Include supports for suction and discharge elbows for pumps.

2. **Structural Steel**: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3. **Support Brackets**: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

4. **Fabrication**: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

### 2.3 SEISMIC-RESTRAINT DEVICES

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.
C. **General Requirements for Restraint Components:** Rated strengths, features, and applications shall be as defined in reports by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].

1. **Structural Safety Factor:** Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

D. **Snubbers:** Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch (6-mm) thick resilient cushion.

E. **Channel Support System:** MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. **Restraint Cables:** [ASTM A 603 galvanized] [ASTM A 492 stainless]-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. **Hanger Rod Stiffener:** [Steel tube or steel slotted-support-system sleeve with internally bolted connections] [Reinforcing steel angle clamped] to hanger rod.

H. **Bushings for Floor-Mounted Equipment Anchor Bolts:** Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. **Bushing Assemblies for Wall-Mounted Equipment Anchorage:** Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

J. **Resilient Isolation Washers and Bushings:** One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

K. **Mechanical Anchor Bolts:** Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

L. **Adhesive Anchor Bolts:** Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:
   1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
   2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).
3. Install seismic-restraint devices using methods approved by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction] providing required submittals for component.

B. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
   3. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction] providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate
with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Cleveland Clinic will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Cleveland Clinic, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   7. Measure isolator deflection.
   8. Verify snubber minimum clearances.
   10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
   11. Test and adjust air-mounting system controls and safeties.
   12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of sprint isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.
3.7 PLUMBING VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment: <Insert name and drawing designation>.

1. Equipment Location: <Insert room number>.
2. Pads:
   a. Material: [Neoprene] [Rubber] [Hermetically sealed compressed fiberglass].
   b. Thickness: <Insert inches (mm)>.
   c. Number of Pads: <Insert number> thick.
3. Isolator Type: <Insert generic name or designation used in Part 2>.
4. Base Type: <Insert generic name or designation used in Part 2>.
5. Minimum Deflection: <Insert inches (mm)>.
6. Component Importance Factor: [1.0] [1.5].
7. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0].
8. Component Amplification Factor: [1.0] [2.5].

END OF SECTION 220548
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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.
1.5 WORK INCLUDED

A. Furnish and install nameplates, valve tags, valve charts, stencils and pipe markers on all Plumbing equipment, and piping.

B. Provide nameplates with the unit number and service designation on all plumbing equipment.

C. Indicate all valve tag numbers on Record Drawings and submit framed under glass valve tag charts including valve service and location.

D. Install color coded ceiling tacks in acoustical tile ceilings or color coded tape on ceiling grid to identify location of equipment, valves and dampers that require regular maintenance or are part of a life safety system (fire dampers, smoke dampers, sprinkler valves or main isolation valves). Concealed fire protection valves shall be marked by red label triangles (3" equilateral) and circle dots (1" diameter). Triangles shall be placed on the wall nearest the valve with the apex pointing toward the ceiling tile. Dots shall be placed on border of ceiling tile.

E. Provide underground plastic pipe markers 6 to 8 inches below finish grade, directly above buried pipes.

F. Provide manufactured pipe and ductwork identification stencils with flow arrows and service indicated. All backgrounds of the stencils shall be color coded with specific service designation.

G. Prepare valve charts and frame under glass. All valves and the tag numbers shall be shown on the Record As-Built Drawings.

H. Provide valve computer data base to match chart.

I. Prepare and install exterior protected brass plaques indicating underground service entrances.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufactures contingent on compliance with the specification.
   1. Seton
   2. W. H. Bradey Company
   3. Marning Services Incorporated

2.2 PIPE IDENTIFICATION AND VALVE TAGS

A. All piping, except that piping which is within inaccessible chases, shall be identified with semi-rigid plastic identification markers equal to Seton Setmark pipe markers.
   1. Direction of flow arrows are to be included on each marker.
   2. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the “Scheme for the Identification of Piping Systems” (ASME A13.1-1981).
3. Setmark snap-around markers shall be used for overall diameters up to 6” and strap-around markers shall be used above 6” overall diameters.

4. Markers shall be located:
   a. Adjacent to each valve
   b. At each branch
   c. At each cap for future
   d. At each riser takeoff,
   e. At each pipe passage through wall (each side)
   f. At each pipe passage at 20’ – 0” intervals maximum.
   g. At each piece of equipment.
   h. At all access doors.
   i. A minimum of one (1) marker shall be provided at each room.

5. Under ground pipe markers:
   a. Provide detectable tape on all underground piping:
   b. Labels shall be color coded and labeled the same as indoors.

B. Valve tags
1. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall include what room(s) the valve serves and piece of equipment served.
2. Valve tags shall be color coded 0.032” anodized aluminum tags, with engraved letters similar to Seton S Type 250-BL or approved equal.
   a. HVAC tags shall be round 2” diameter, similar to Seton 15426.
   b. Plumbing tags shall be square 2” x 2” similar to Seton 42769.
   c. Fire Protection tags shall be square 2” x 2” similar to Seton 42769 RED.
   d. Lettering shall be ¼” high for type service and ½” for valve number. Tag shall indicate service and valve number.
   e. Each service shall be a different color.
3. Tag shall be attached to valves with chain similar to Seton No 16 stainless steel jack chain.
4. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.
5. Provide a tag for every valve except:
   a. Perimeter radiation shut-off valves that are located at the finned tube radiation element within the accessible (from the space) heating enclosure

C. Furnish a minimum of two (2) typed valve lists
1. Each framed under glass or Plexiglas. Each chart shall be enclosed in an approved 0.015” thick plastic closure for permanent protection.
2. Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valve lists.
3. The printed list shall include the valve number, location and purpose of each valve.
4. It shall state other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
5. Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by the Cleveland Clinic.

D. Valve database.
1. Provide a valve database for all valves to operate on the building computer.
2. Every valve shall include:
   a. Tag Number
2.3 EQUIPMENT NAMEPLATES

A. Equipment nameplates shall be 3” x 6” long, 0.02” aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.

B. The nameplate shall contain the unit or equipment designation (“AHU” for air handling unit, “P” for circulating pump, etc.), unit number and area or system served.

C. Nameplates for exterior equipment shall be applied with waterproof adhesive.

2.4 UTILITY ENTRANCE DESIGNATIONS

A. Provide a brass wall plaque, minimum 0.020” thickness, secured to the exterior wall just above the grade line for all buried service entrances or exits. Samples are: Water Service Below; Gas Service Below; Sanitary Sewer Below; Storm Sewer Below; Irrigation Water Below; etc.

B. Ceiling Tacks or Tape.

C. Provide steel color coded 3/4 inch diameter ceiling tacks in acoustical tile ceilings or color coded tape applied to ceiling grid to locate equipment, valves or dampers that require regular maintenance or are part of a Life Safety System.

D. The tacks or tapes shall be color codes as follows:
   1. Yellow – HVAC
   2. Red – Life Safety (fire dampers, sprinkler valves, etc.)

PART 3 - EXECUTION

3.1 PREPARATION

A. All surfaces shall be cleaned and insulated (if applicable) prior to installing any identification.

B. Exterior surfaces of outdoor equipment shall be dry and prepared to accept the specified identification.
3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion. Seal with clear lacquer.

B. Install valve tags with chain.

C. Install duct markers in accordance with manufacturer’s instructions.

D. Install plastic pipe markers in accordance with manufacturer’s Instructions.

E. Install plastic tape markers complete around pipe in accordance with manufacturer’s instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify air handling units, pumps, domestic hot water heaters, fire pumps, heat transfer equipment tanks, water treatment devices, etc. with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Install detector tape on all underground services in accordance with the manufactures recommendations.

J. Identify thermostats relating to air handling equipment serving multiple spaces.

K. Identify valves in main and branch piping with valve tags.

L. Tag automatic controls, instruments and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with pipe markers or where buried using plastic tape pipe markers. Use tags on piping ¾ inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 230553
SECTION 220716 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing equipment:

1. Domestic water boiler breechings.
2. Domestic water heat exchangers.
3. Domestic water converters.
4. Domestic water, [hot-water] [cold-water] [and] [chilled-water] pumps.
5. Domestic water storage tanks.
6. Domestic water filter housings.

B. Related Sections:

1. Section 220719 "Plumbing Piping Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

C. 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 removable insulation at equipment connections and access panels.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
1. Sheet Form Insulation Materials: 12 inches (300 mm) square.
2. Sheet Jacket Materials: 12 inches (300 mm) square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.
B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
B. Coordinate clearance requirements with equipment Installer for equipment insulation application.
C. Coordinate installation and testing of heat tracing.
1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Domestic Water Boiler Breeching Insulation Schedule" and "Equipment 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. Calcium Silicate:

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. Industrial Insulation Group (IIG); Thermo-12 Gold.

2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. Pittsburgh Corning Corporation; Foamglas.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class I.
6. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.

7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Aeroflex USA, Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. K-Flex USA; Insul-Sheet and K-FLEX LS.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

J. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Industrial Insulation Group (IIG); MinWool-1200 Flexible Batt.
   b. Johns Manville; HTB 26 Spin-Glas.
   c. Roxul Inc.; Roxul RW.

K. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied FSK jacket]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; CertaPro Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

L. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; FBX.
   b. Industrial Insulation Group (IIG); MinWool-1200 Industrial Board.
   c. Rock Wool; Delta Board.
   d. Roxul Inc.; RHT and RockBoard.
   e. Thermafiber, Inc.; Thermafiber Industrial Felt.

M. Mineral-Fiber, Preformed Pipe Insulation:

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000-Degree Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A. [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied ASJ-SSL]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

N. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied [ASJ] [FSK jacket] complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.

O. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Armacell LLC; Tubolit.
   b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

2.2 INSULATING CEMENTS

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
   1. **Products**: Subject to compliance with requirements, provide one of the following:
      a. Ramco Insulation, Inc.; Thermokote V.

   1. **Products**: Subject to compliance with requirements, provide one of the following:
      a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

### 2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
   1. **Products**: Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 290.
      d. Mon-Eco Industries, Inc.; 22-30.
      e. Vimasco Corporation; 760.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
   1. **Products**: Subject to compliance with requirements, provide one of the following:

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Aeroflex USA, Inc.; Aeroseal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. **Mineral-Fiber Adhesive:** Comply with MIL-A-3316C, Class 2, Grade A.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 225.
      d. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. **ASJ Adhesive, and FSK and PVDC Jacket Adhesive:** Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 225.
      d. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. **PVC Jacket Adhesive:** Compatible with PVC jacket.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 739, Dow Silicone.
      d. Speedline Corporation; Polyco VP Adhesive.
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      b. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
   4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 501.
      d. Mon-Eco Industries, Inc.; 55-10.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
   3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      b. Eagle Bridges - Marathon Industries; 570.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. **Products**: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 550.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.

### 2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. **Products**: Subject to compliance with requirements, provide one of the following:
   c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over insulation.
4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).

### 2.6 SEALANTS

A. Joint Sealants:

1. **Joint Sealants for Cellular-Glass Products**: Subject to compliance with requirements, provide one of the following:
b. Eagle Bridges - Marathon Industries; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

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 (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. **Products**: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

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 (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. **Products**: Subject to compliance with requirements, provide one of the following:

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 (Minus 40 to plus 121 deg C).
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2.7 FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

5. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. in. (2 strands by 2 strands/sq. mm) for covering equipment.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas No. 5.
B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for equipment.

1. **Products**: Subject to compliance with requirements, provide one of the following:
   b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. **Products**: Subject to compliance with requirements, provide one of the following:

2.10 FIELD-APPLIED JACKETS

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

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

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Zeston.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: [White] [Color-code jackets based on system. Color as selected by Architect].
4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. **Products**: Subject to compliance with requirements, provide one of the following:
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

a. **Sheet and roll stock ready for shop or field sizing** [Factory cut and rolled to size].

b. Finish and thickness are indicated in field-applied jacket schedules.

c. **Moisture Barrier for Indoor Applications**: [1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper] [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].

d. **Moisture Barrier for Outdoor Applications**: [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].

3. **Stainless-Steel Jacket**: ASTM A 167 or ASTM A 240/A 240M.

   a. **Sheet and roll stock ready for shop or field sizing** [Factory cut and rolled to size].

   b. Material, finish, and thickness are indicated in field-applied jacket schedules.

   c. **Moisture Barrier for Indoor Applications**: [1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper] [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].

   d. **Moisture Barrier for Outdoor Applications**: [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].

### 2.11 TAPES

**A. ASJ Tape**: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. **Products**: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.

   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.

   c. Compac Corporation; 104 and 105.

   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. **Width**: 3 inches (75 mm).

3. **Thickness**: 11.5 mils (0.29 mm).

4. **Adhesion**: 90 ounces force/inch (1.0 N/mm) in width.

5. **Elongation**: 2 percent.

6. **Tensile Strength**: 40 lbf/inch (7.2 N/mm) 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. **Products**: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.

   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

   c. Compac Corporation; 110 and 111.

   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. **Width**: 3 inches (75 mm).
3. **Thickness:** 6.5 mils (0.16 mm).
4. **Adhesion:** 90 ounces force/inch (1.0 N/mm) in width.
5. **Elongation:** 2 percent.
6. **Tensile Strength:** 40 lbf/inch (7.2 N/mm) 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. **Products:** Subject to compliance with requirements, provide one of the following:
   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. **Width:** 2 inches (50 mm).
3. **Thickness:** 6 mils (0.15 mm).
4. **Adhesion:** 64 ounces force/inch (0.7 N/mm) in width.
5. **Elongation:** 500 percent.
6. **Tensile Strength:** 18 lbf/inch (3.3 N/mm) in width.

**D. Aluminum-Foil Tape:** Vapor-retarder tape with acrylic adhesive.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. **Width:** 2 inches (50 mm).
3. **Thickness:** 3.7 mils (0.093 mm).
4. **Adhesion:** 100 ounces force/inch (1.1 N/mm) in width.
5. **Elongation:** 5 percent.
6. **Tensile Strength:** 34 lbf/inch (6.2 N/mm) in width.

**E. PVDC Tape:** White vapor-retarder PVDC tape with acrylic adhesive.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape and Saran 560 Vapor Retarder Tape.

2. **Width:** 3 inches (75 mm).
3. **Film Thickness:** [4 mils (0.10 mm)] [6 mils (0.15 mm)].
4. **Adhesive Thickness:** 1.5 mils (0.04 mm).
5. **Elongation at Break:** 145 percent.
6. **Tensile Strength:** 55 lbf/inch (10.1 N/mm) in width.
2.12 SECUREMENTS

A. Bands:

1. **Products**: Subject to compliance with requirements, provide one of the following:
   
   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316]; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].

3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].


B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch- (2.6-mm-)] [0.135-inch- (3.5-mm-)] diameter shank, length to suit depth of insulation indicated.
   
   a. **Products**: Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch- (2.6-mm-)] [0.135-inch- (3.5-mm-)] diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
   
   a. **Products**: Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
   
   a. **Products**: Subject to compliance with requirements, provide one of the following:
      
      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: [Copper- or zinc-coated, low-carbon steel] [Aluminum] [Stainless steel], fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. **Products**: Subject to compliance with requirements, provide one of the following:

   1) GEMCO; Nylon Hangers.
   2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.

c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. **Products**: Subject to compliance with requirements, provide one of the following:

   1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
   2) GEMCO; Peel & Press.
   3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: [Copper- or zinc-coated, low-carbon steel] [Aluminum] [Stainless steel], fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, [galvanized-steel] [aluminum] [stainless-steel] sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. **Products**: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; RC 150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

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

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

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


2.13 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

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.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm)] [4 inches (100 mm)] 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.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
5. Handholes.
6. Cleanouts.
3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
   a. Do not weld anchor pins to ASME-labeled pressure vessels.
   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
   c. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
   d. Do not overcompress insulation during installation.
   e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
   f. Impale insulation over anchor pins and attach speed washers.
   g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches (75 mm).
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply [100] [50] percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from [galvanized steel] [aluminum] [stainless steel], at least [0.040 inch (1.0 mm)] [0.050 inch (1.3 mm)] [0.060 inch (1.6 mm)] thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Domestic Water Boiler Breechings:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation material.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.

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.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:
   1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
   2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 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.

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.
3.9 FIELD QUALITY CONTROL

A. Testing Agency: Cleveland Clinic will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DOMESTIC WATER BOILER BREECHING INSULATION SCHEDULE

A. Round, exposed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches (100 mm) thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

B. Round, concealed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches (100 mm) thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

C. Rectangular, exposed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches (100 mm) thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

D. Rectangular, concealed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches (100 mm) thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
3.11 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

C. Heat-exchanger (water-to-water for domestic water heating service) insulation shall be one of the following:
   1. Calcium Silicate: 3 inches (75 mm) thick.
   2. Cellular Glass: 3 inches (75 mm) thick.
   3. Mineral-Fiber Blanket: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   4. Mineral-Fiber Board: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   5. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
   6. Mineral-Fiber Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

D. Steam-to-hot-water converter insulation shall be one of the following:
   1. Calcium Silicate: 3 inches (75 mm) thick.
   2. Cellular Glass: 3 inches (75 mm) thick.
   3. Mineral-Fiber Blanket: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   4. Mineral-Fiber Board: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   5. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
   6. Mineral-Fiber Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

E. Domestic water pump insulation shall be one of the following:
   1. Cellular Glass: 2 inches (50 mm) thick.
   2. Mineral-Fiber Blanket: 1 inch (25 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   3. Mineral-Fiber Board: 1 inch (25 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

F. Domestic chilled-water (potable) pump insulation shall be one of the following:
   1. Cellular Glass: 3 inches (75 mm) thick.
   2. Mineral-Fiber Blanket: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
   3. Mineral-Fiber Board: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

G. Domestic hot-water pump insulation shall be one of the following:
   1. Cellular Glass: 2 inches (50 mm) thick.
   2. Mineral-Fiber Blanket: 1 inch (25 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
3. Mineral-Fiber Board: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.

H. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be one of the following:

1. Cellular Glass: **1-1/2 inches (38 mm)** thick.
2. Flexible Elastomeric: **1 inch (25 mm)** thick.
3. Mineral-Fiber Blanket: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
4. Mineral-Fiber Board: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
5. Mineral-Fiber Pipe and Tank: **1 inch (25 mm)** thick.
6. Polyolefin: **1 inch (25 mm)** thick.

I. Domestic hot-water storage tank insulation shall be one of the following, of thickness to provide an R-value of 12.5:

1. Cellular Glass.

J. Domestic water storage tank insulation shall be one of the following:

1. Cellular Glass: **2 inches (50 mm)** thick.
2. Flexible Elastomeric: **1 inch (25 mm)** thick.
3. Mineral-Fiber Blanket: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
4. Mineral-Fiber Board: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
5. Mineral-Fiber Pipe and Tank: **1 inch (25 mm)** thick.
6. Polyolefin: **1 inch (25 mm)** thick.

K. Domestic chilled-water (potable) storage tank insulation shall be one of the following:

1. Cellular Glass: **2 inches (50 mm)** thick.
2. Flexible Elastomeric: **1 inch (25 mm)** thick.
3. Mineral-Fiber Blanket: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
4. Mineral-Fiber Board: **1 inch (25 mm)** thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
5. Mineral-Fiber Pipe and Tank: **1 inch (25 mm)** thick.
6. Polyolefin: **1 inch (25 mm)** thick.

L. Domestic water filter-housing insulation shall be one of the following:

1. Cellular Glass: **3 inches (75 mm)** thick.
2. Mineral-Fiber Blanket: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
3. Mineral-Fiber Board: 2 inches (50 mm) thick and [2-lb/cu. ft. (32-kg/cu. m)] [3-lb/cu. ft. (48-kg/cu. m)] [6-lb/cu. ft. (96-kg/cu. m)] nominal density.
4. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

[Retain one of six subparagraphs below.]

1. None.
2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

D. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):

[Retain one of six subparagraphs below.]

1. None.
2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

E. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):

[Retain one of four subparagraphs below.]

1. None.
2. [Painted] Aluminum, [Smooth] [Stucco Embossed] with [1-1/4-Inch- (32-mm-) Deep Corrugations] [2-1/2-Inch- (65-mm-) Deep Corrugations] [4-by-1-Inch (100-by-25-mm) Box Ribs]: [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.

3. Stainless Steel, [Type 304] [or] [Type 316], [Smooth] [Stucco Embossed], with [1-1/4-Inch- (32-mm-) Deep Corrugations] [2-1/2-Inch- (65-mm-) Deep Corrugations] [4-by-1-Inch (100-by-25-mm) Box Ribs]: [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

[Retain one of six subparagraphs below.]

1. None.
2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

D. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):

[Retain one of three subparagraphs below.]

1. [Painted] Aluminum, [Smooth] [Corrugated] [Stucco Embossed] [with Z-Shaped Locking Seam]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
2. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed] [with Z-Shaped Locking Seam]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

E. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):

[Retain one of three subparagraphs below.]

1. [Painted] Aluminum, [Smooth] [Stucco Embossed] with [1-1/4-Inch- (32-mm-) Deep Corrugations] [2-1/2-Inch- (65-mm-) Deep Corrugations] [4-by-1-Inch (100-by-25-mm) Box Ribs]: [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
2. Stainless Steel, [Type 304] [or] [Type 316], [Smooth] [Stucco Embossed], with [1-1/4-Inch- (32-mm-) Deep Corrugations] [2-1/2-Inch- (65-mm-) Deep Corrugations] [4-by-1-Inch (100-by-25-mm) Box Ribs]: [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

END OF SECTION 220716
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 insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

C. 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.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
3. Sheet Jacket Materials: 12 inches (300 mm) square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:


1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS


B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. **Products:** Subject to compliance with requirements, provide the following:

   a. [Pittsburgh Corning Corporation; Foamglas](#).
2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000-Degree Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied ASJ-SSL]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS


1. Products: Subject to compliance with requirements, provide the following:
   a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, provide the following:
   a. Ramco Insulation, Inc.; Thermokote V.

1. **Products**: Subject to compliance with requirements, provide the following:
   a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

### 2.3 ADHESIVES

**A.** Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

**B.** Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. **Products**: Subject to compliance with requirements, provide the following:

2. **Products**: For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**C.** Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. **Products**: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. **Products**: For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**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. **Products**: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. **Products**: For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; 739, Dow Silicone.
   d. Speedline Corporation; Polyc Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.


C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 501.
   d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.

3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).


D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 570.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. **Products:** Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 550.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. **Products:** Subject to compliance with requirements, provide one of the following:
   c. Vimasco Corporation; 713 and 714.
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).


2.6 SEALANTS

A. Joint Sealants:

1. **Joint Sealants for Cellular-Glass and Phenolic Products**: Subject to compliance with requirements, provide one of the following:

   b. Eagle Bridges - Marathon Industries; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

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 (Minus 73 to plus 149 deg C).

5. Color: White or gray.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. **Products**: Subject to compliance with requirements, provide one of the following:

   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

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 (Minus 40 to plus 121 deg C).

5. Color: Aluminum.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. **Products**: Subject to compliance with requirements, provide the following:

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 (Minus 40 to plus 121 deg C).
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, provide the following:


B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, provide one of the following:


b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. Products: Subject to compliance with requirements, provide the following:
2.10 FIELD-APPLIED JACKETS

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

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

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Zeston.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: [White] [Color-code jackets based on system. Color as selected by Architect].
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. Metal Jacket:

1. **Products:** Subject to compliance with requirements, provide one of the following:
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

   a. [Sheet and roll stock ready for shop or field sizing] [Factory cut and rolled to size].
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: [1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper] [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].
   d. Moisture Barrier for Outdoor Applications: [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].
   e. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
   a. [Sheet and roll stock ready for shop or field sizing] [Factory cut and rolled to size].
   b. Material, finish, and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: [1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper] [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].
   d. Moisture Barrier for Outdoor Applications: [3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper] [2.5-mil- (0.063-mm-) thick polysurlyn].
   e. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      a. Pittsburgh Corning Corporation; Pittwrap.
      b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.11 **TAPES**

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. **Products:** Subject to compliance with requirements, provide one of the following:
      a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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. **Products**: Subject to compliance with requirements, provide one of the following:
   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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. **Products**: Subject to compliance with requirements, provide one of the following:
   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. **Products**: Subject to compliance with requirements, provide one of the following:
   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.
2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.12 SECUREMENTS

A. Bands:

1. **Products:** Subject to compliance with requirements, provide one of the following:
   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316]; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].

3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: [0.080-inch (2.0-mm) nickel-copper alloy] [0.062-inch (1.6-mm) soft-annealed, stainless steel] [0.062-inch (1.6-mm) soft-annealed, galvanized steel].

1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, *<Insert drawing designation>*:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. Engineered Brass Company.
   b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
   c. McGuire Manufacturing.
   d. Plumberex.
   e. Truebro; a brand of IPS Corporation.
   f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. **Description:** Manufactured plastic wraps for covering plumbing fixture [hot-water supply] [hot- and cold-water supplies] and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. **Protective Shielding Piping Enclosures, **<Insert drawing designation>**:**

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. **Truebro; a brand of IPS Corporation.**
   b. **Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.**
   c. **Plumberex**

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 **EXAMINATION**

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 **PREPARATION**

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. **Stainless Steel:** Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. **Carbon Steel:** Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm)] [4 inches (100 mm)] 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 (100 mm) 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.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) 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 (50 mm).

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."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter.
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 (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) 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 (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) 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 (25 mm), 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.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.

B. 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 (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders 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.

C. 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 block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
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.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Seal split-tube 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 polyolefin 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 polyolefin 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 cut sections of polyolefin pipe and sheet 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.
   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.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.
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 (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

Where PVC jackets are indicated, install with 1-inch (25-mm) 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.

Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

3.12 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.

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.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Cleveland Clinic will engage a qualified testing agency to 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.

3.14 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.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. **NPS 1 (DN 25) and Smaller:** Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch (13 mm)] [1 inch (25 mm)] thick.

2. **NPS 1-1/4 (DN 32) and Larger:** Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. **NPS 1-1/4 (DN 32) and Smaller:** Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch (13 mm)] [1 inch (25 mm)] thick.

2. **NPS 1-1/2 (DN 40) and Larger:** Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch (25 mm)** thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch (25 mm)** thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **[1/2 inch (13 mm)] [1 inch (25 mm)]** thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1-1/2 inches (38 mm)** thick.

H. Floor Drains, Traps, and Sanitary Drain Piping within **10 Feet (3 m)** of Drain Receiving Condensate and Equipment Drain Water below **60 Deg F (16 Deg C)**:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **[1/2 inch (13 mm)] [1 inch (25 mm)]** thick.

I. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: **1 inch (25 mm)** thick.

J. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: **1 inch (25 mm)** thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **2 inches (50 mm)** thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **2 inches (50 mm)** thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **2 inches (50 mm)** thick.

D. Hot Service Drains:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: **1 inch (25 mm)** thick.

E. Hot Service Vents:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type II: **1 inch (25 mm)** thick.

3.17 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE
A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, **2 inches (50 mm)** thick.

3.18 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:

   **[Retain one of six subparagraphs below.]**

   1. None.
   2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
   3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
   4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] thick.
   5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

D. Piping, Exposed:

   **[Retain one of six subparagraphs below.]**

   1. None.
   2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
   3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] thick.
5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

3.19 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

[Retain one of six subparagraphs below.]

1. None.
2. [PVC] [PVC, Color-Coded by System]: [20 mils (0.5 mm)] [30 mils (0.8 mm)] thick.
3. Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
4. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
5. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

D. Piping, Exposed:

[Retain one of four subparagraphs below.]

1. PVC: [20 mils (0.5 mm)] [30 mils (0.8 mm)] [40 mils (1.0 mm)] thick.
2. [Painted] Aluminum, [Smooth] [Corrugated] [Stucco Embossed] [with Z-Shaped Locking Seam]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] [0.040 inch (1.0 mm)] thick.
3. Stainless Steel, [Type 304] [or] [Type 316], [Smooth 2B Finish] [Corrugated] [Stucco Embossed] [with Z-Shaped Locking Seam]: [0.010 inch (0.25 mm)] [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] thick.

3.20 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.
SECTION 221116 - DOMESTIC WATER 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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.
2. Piping shall be American made.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Cleveland Clinic or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Construction Manager and Cleveland Clinic Plumbing Supervisor no fewer than 7 days in advance of proposed interruption of water service.
2. Do not interrupt water service without Cleveland Clinic Plumbing Supervisor’s written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: \([\text{ASTM B 88, Type K (ASTM B 88M, Type A)}] \text{ and } [\text{ASTM B 88, Type L (ASTM B 88M, Type B)}]\) water tube, drawn temper.

B. Soft Copper Tube: \([\text{ASTM B 88, Type K (ASTM B 88M, Type A)}] \text{ and } [\text{ASTM B 88, Type L (ASTM B 88M, Type B)}]\) water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.


E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:
   1. MSS SP-123.
   4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Viega.
   2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
H. Copper Push-on-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. **Victaulic Company.**
   2. Description:
      a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Appurtenances for Grooved-End Copper Tubing:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. **Anvil International.**
      b. **Shurjoint Piping Products.**
      c. **Victaulic Company.**
   2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
   3. Mechanical Couplings for Grooved-End Copper Tubing:
      a. Copper-tube dimensions and design similar to AWWA C606.
      b. Ferrous housing sections.
      c. EPDM-rubber gaskets suitable for hot and cold water.
      d. Bolts and nuts.
      e. Minimum Pressure Rating: 300 psig (2070 kPa).

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51.
   2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.

F. Compact-Pattern, Push-on-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.


H. Appurtenances for Grooved-End, Ductile-Iron Pipe:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Shurjoint Piping Products.
      b. Victaulic Company.
   2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
   3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
      a. AWWA C606 for ductile-iron-pipe dimensions.
      b. Ferrous housing sections.
      c. EPDM-rubber gaskets suitable for hot and cold water.
      d. Bolts and nuts.
      e. Minimum Pressure Rating:
         1) NPS 14 to NPS 18 (DN 350 to DN 450): 250 psig (1725 kPa).
         2) NPS 20 to NPS 46 (DN 500 to DN 900): 150 psig (1035 kPa).

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:
   1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
   2. Include ends matching joining method.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:
   1. ASME B16.39, Class 150.
   2. Hexagonal-stock body.
   4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International
      b. Grinnell Mechanical Products; Tyco Fire Products LP
      c. Shurjoint Piping Products
      d. Victaulic Company
   2. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
   3. Fittings for Grooved-End, Galvanized-Steel Pipe:
      a. AWWA C606 for steel-pipe dimensions.
      b. Ferrous housing sections.
      c. EPDM-rubber gaskets suitable for hot and cold water.
      d. Bolts and nuts.
      e. Minimum Pressure Rating:
         1) NPS 8 (DN 200) and Smaller: 600 psig (4137 kPa).
         2) NPS 10 and NPS 12 (DN 250 to DN 300): 400 psig (2758 kPa).
         3) NPS 14 to NPS 24 (DN 350 to DN 600): 250 psig (1725 kPa).

2.5 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, [Schedule 10] [and] [Schedule 40].

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

D. Appurtenances for Grooved-End, Stainless-Steel Pipe:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International.
   b. Grinnell Mechanical Products; Tyco Fire Products LP.
   c. Shurjoint Piping Products.
   d. Victaulic Company.

3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:
   a. AWWA C606 for stainless-steel-pipe dimensions.
   b. Stainless-steel housing sections.
   c. Stainless-steel bolts and nuts.
   d. EPDM-rubber gaskets suitable for hot and cold water.
   e. Minimum Pressure Rating:

   1) NPS 8 (DN 200) and Smaller: 600 psig (4137 kPa).
   2) NPS 10 and NPS 12 (DN 250 to DN 300): 400 psig (2758 kPa).
   3) NPS 14 to NPS 24 (DN 350 to DN 600): 250 psig (1725 kPa).

2.6 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) 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 A5.8/A5.8M, 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.

2.7 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: [Sheet] [or] [tubing].

C. Color: [Black] [or] [natural].
2.8 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Piping Specialties Products.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc.; a Sensus company.
      g. Viking Johnson.

2.9 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
      b. Central Plastics Company.
      d. Jomar International.
      e. Matco-Norca.
      g. Watts; a division of Watts Water Technologies, Inc.
      h. Wilkins; a Zurn company.
   3. Pressure Rating: \([125 \text{ psig (860 kPa) minimum at 180 deg F (82 deg C)}] [150 \text{ psig (1035 kPa)}] [250 \text{ psig (1725 kPa)}]\).

C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
   b. Central Plastics Company.
   c. Matco-Norca.
   d. Watts; a division of Watts Water Technologies, Inc.
   e. Wilkins; a Zurn company.


3. Factory-fabricated, bolted, companion-flange assembly.

4. Pressure Rating: \[
   125 \text{ psig (860 kPa) minimum at 180 deg F (82 deg C)} \] \[
   150 \text{ psig (1035 kPa)} \] \[
   175 \text{ psig (1200 kPa)} \] \[
   300 \text{ psig (2070 kPa)} \].

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.
   d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.

3. Pressure Rating: \[
   150 \text{ psig (1035 kPa)} \].

4. Gasket: Neoprene or phenolic.

5. Bolt Sleeves: Phenolic or polyethylene.


E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elster Perfection Corporation.
   b. Grinnell Mechanical Products; Tyco Fire Products LP.
   c. Matco-Norca.
   d. Precision Plumbing Products, Inc.
   e. Victaulic Company.


3. Electroplated steel nipple complying with ASTM F 1545.

4. Pressure Rating and Temperature: \[
   300 \text{ psig (2070 kPa) at 225 deg F (107 deg C)} \].

5. End Connections: Male threaded or grooved.

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 underground [copper tube] [and] [ductile-iron pipe] in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 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. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. 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.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. [Square cut] [Roll] groove ends of pipe as specified. 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.

L. 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.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

N. 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 (DN 40) and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) 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 (DN 50) and Smaller: Use dielectric [couplings] [couplings or nipples] [nipples] [unions].

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [flanges] [flange kits] [nipples].

D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

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 (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) 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 (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

J. Install supports for vertical stainless-steel piping every 15 feet (4.5 m).

K. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
L. Install supports for vertical PP piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

M. Support piping and tubing not listed in this article according to MSS SP-69 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 (DN 65) 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 (345 kPa) 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.
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 (50 mg/L) 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 (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Repeat procedures if biological examination shows contamination.
   e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. Soft copper tube, [ASTM B 88, Type K (ASTM B 88M, Type A)]; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal fittings; and pressure-sealed] joints.

D. Under-building-slab, domestic water, building-service piping, NPS 2-1/2 to NPS 8 (DN 65 to DN 200) and larger, shall be one of the following:
   1. Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.
   2. Push-on-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, push-on-joint fittings; and gasketed joints.
   3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

E. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300), shall be one of the following:
   1. Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.
   2. Push-on-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, push-on-joint fittings; and gasketed joints.
   3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

F. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. [Hard] [or] [soft] copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal-joint fittings; and pressure-sealed] joints.

G. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
   2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; copper pressure-seal-joint fittings; and pressure-sealed joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
   1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
   2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; grooved-joint, copper-tube appurtenances; and grooved joints.

I. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the following:

1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)]; grooved-joint, copper-tube appurtenances; and grooved joints.

3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

4. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

5. Stainless-steel [Schedule 10] [Schedule 40] pipe, grooved-joint fittings, and grooved joints.

J. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300), shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.


3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.


B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116
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.
5. Temperature-actuated, water mixing valves.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
12. Post hydrants.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224713 "Drinking Fountains" for water filters for water coolers.
7. Section 224716 "Pressure Water Coolers" for water filters for water coolers.
8. Section 224723 "Remote Water Coolers" for water filters for water coolers.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61[ and NSF 14],[ Mark "NSF-pw" on plastic piping components.]

B. Products shall be American made.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
      b. Cash Acme; a division of Reliance Worldwide Corporation.
      c. Conbraco Industries, Inc.
      d. FEBCO; a division of Watts Water Technologies, Inc.
DOMESTIC WATER PIPING SPECIALTIES

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Inlet and Outlet Connections: Threaded.
6. Finish: [Rough bronze] [Chrome plated].

B. Hose-Connection Vacuum Breakers <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arrowhead Brass Products.
   b. Cash Acme; a division of Reliance Worldwide Corporation.
   c. Conbraco Industries, Inc.
   d. Legend Valve.
   e. MIFAB, Inc.
   f. Prier Products, Inc.
   g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   h. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   i. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
   j. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

5. Finish: [Chrome or nickel plated] [Rough bronze].

C. Pressure Vacuum Breakers <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
   b. Conbraco Industries, Inc.
   c. FEBCO; a division of Watts Water Technologies, Inc.
   d. Flomatic Corporation.
   e. Toro Company (The); Irrigation Div.
   f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.
5. Size: <Insert NPS (DN)>.
6. Design Flow Rate: <Insert gpm (L/s)>.
7. Selected Unit Flow Range Limits: <Insert gpm (L/s)>.
8. Pressure Loss at Design Flow Rate: <Insert psig (kPa)>.
9. Accessories:
   a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
      d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
   3. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10) matching faucet size.
   5. End Connections: Threaded.
   6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   3. Operation: Continuous-pressure applications.
   4. Size: [NPS 1/4 (DN 8)] [NPS 3/8 (DN 10)] [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] [NPS 1 (DN 25)].
   5. Accessories:
      a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cash Acme; a division of Reliance Worldwide Corporation.
      b. Conbraco Industries, Inc.
      c. FEBCO; a division of Watts Water Technologies, Inc.
      d. Honeywell International Inc.
      e. Legend Valve.
      f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)].
5. Body: Bronze.
7. Finish: [Chrome plated] [Rough bronze].

B. Reduced-Pressure-Principle Backflow Preventers <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
   b. Conbraco Industries, Inc.
   c. FEBCO; a division of Watts Water Technologies, Inc.
   d. Flomatic Corporation.
   e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle third of flow range.
5. Size: <Insert NPS (DN)>.
6. Design Flow Rate: <Insert gpm (L/s)>.
7. Selected Unit Flow Range Limits: <Insert gpm (L/s)>.
8. Pressure Loss at Design Flow Rate: <Insert psig (kPa)> for sizes NPS 2 (DN 50) and smaller; <Insert psig (kPa)> for NPS 2-1/2 (DN 65) and larger.
9. Body: Bronze for NPS 2 (DN 50) and smaller; [cast iron with interior lining that complies with AWWA C550 or that is FDA approved] [steel with interior lining that complies with AWWA C550 or that is FDA approved] [stainless steel] for NPS 2-1/2 (DN 65) and larger.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; [flanged] <Insert type> for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for [horizontal, straight-through] [vertical-inlet, horizontal-center-section, and vertical-outlet] [vertical] flow.
12. Accessories:
   a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   d. Integral strainer.

C. Double-Check, Backflow-Prevention Assemblies <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
b. Conbraco Industries, Inc.
c. FEBCO; a division of Watts Water Technologies, Inc.
d. Flomatic Corporation.
e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: \textbf{5 psig (35 kPa)} maximum, through middle third of flow range.
5. Size: \textbf{<Insert NPS (DN)>>}.
6. Design Flow Rate: \textbf{<Insert gpm (L/s)>>}.
7. Selected Unit Flow Range Limits: \textbf{<Insert gpm (L/s)>>}.
8. Pressure Loss at Design Flow Rate: \textbf{<Insert psig (kPa)>> for sizes NPS 2 (DN 50) and smaller; <Insert psig (kPa)>> for NPS 2-1/2 (DN 65) and larger.}
9. Body: Bronze for NPS 2 (DN 50) and smaller; \begin{itemize}
    \item [cast iron with interior lining that complies with AWWA C550 or that is FDA approved]
    \item [steel with interior lining that complies with AWWA C550 or that is FDA approved]
    \item [stainless steel]
\end{itemize} for NPS 2-1/2 (DN 65) and larger.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for horizontal, straight-through flow.
12. Accessories:
   a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

D. Beverage-Dispensing-Equipment Backflow Preventers \textbf{<Insert drawing designation if any>>:}

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).

E. Dual-Check-Valve Backflow Preventers \textbf{<Insert drawing designation if any>>:}

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme; a division of Reliance Worldwide Corporation.
   b. Conbraco Industries, Inc.
c. FEBCO; a division of Watts Water Technologies, Inc.
d. Flomatic Corporation.
e. Ford Meter Box Company, Inc. (The).
f. Honeywell International Inc.
g. Legend Valve.
h. McDonald, A. Y. Mfg. Co.
i. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Operation: Continuous-pressure applications.
4. Size: [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] [NPS 1 (DN 25)] [NPS 1-1/4 (DN 32)].
5. Body: Bronze with union inlet.

F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme; a division of Reliance Worldwide Corporation.
   b. Lancer Corporation.
   c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).

G. Reduced-Pressure-Detector, Fire-Protection, Backflow-Preventer Assemblies <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
   b. Conbraco Industries, Inc.
   c. FEBCO; a division of Watts Water Technologies, Inc.
   d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1047 and is FM Global approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle third of flow range.
5. Size: <Insert NPS (DN)>.
6. Design Flow Rate: <Insert gpm (L/s)>.
7. Selected Unit Flow Range Limits: <Insert gpm (L/s)>.
8. Pressure Loss at Design Flow Rate: <Insert psig (kPa)>.
9. Body: [Cast iron with interior lining that complies with AWWA C550 or that is FDA approved] [Steel with interior lining that complies with AWWA C550 or that is FDA approved] [Stainless steel].


11. Configuration: Designed for [horizontal, straight-through] [vertical-inlet, horizontal-center-section, and vertical-outlet] [vertical] flow.

12. Accessories:
   a. Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

H. Double-Check, Detector-Assembly Backflow Preventers <Insert drawing designation if any>:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
      b. Conbraco Industries, Inc.
      c. FEBCO; a division of Watts Water Technologies, Inc.
      d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

   2. Standard: ASSE 1048 and is FM Global approved or UL listed.
   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.
   5. Size: <Insert NPS (DN)>
   6. Design Flow Rate: <Insert gpm (L/s)>
   7. Selected Unit Flow Range Limits: <Insert gpm (L/s)>
   8. Pressure Loss at Design Flow Rate: <Insert psig (kPa)>

   9. Body: [Cast iron with interior lining that complies with AWWA C550 or that is FDA approved] [Steel with interior lining that complies with AWWA C550 or that is FDA approved] [Stainless steel].
   11. Configuration: Designed for [horizontal, straight-through] [vertical-inlet, horizontal-center-section, and vertical-outlet] [vertical] flow.
   12. Accessories:
      a. Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
      b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

I. Hose-Connection Backflow Preventers <Insert drawing designation if any>:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
3. Operation: Up to 10-foot head of water (30-kPa) back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm (0.19-L/s) flow.

J. Backflow-Preventer Test Kits <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. FEBCO; a division of Watts Water Technologies, Inc.
   c. Flomatic Corporation.
   d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme; a division of Reliance Worldwide Corporation.
   b. Conbraco Industries, Inc.
   c. Honeywell International Inc.
   d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Size: <Insert NPS (DN)>.
5. Design Flow Rate: <Insert gpm (L/s)>.
6. Design Inlet Pressure: <Insert psig (kPa)>.
7. Design Outlet Pressure Setting: <Insert psig (kPa)>.
8. Body: Bronze[ with chrome-plated finish] for NPS 2 (DN 50) and smaller; cast iron[ with interior lining that complies with AWWA C550 or that is FDA approved] for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water-Control Valves <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa) minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
   a. Size: <Insert NPS (DN)>.
   b. Pattern: [Angle] [Globe]-valve design.
   c. Trim: Stainless steel.
5. Design Flow: <Insert gpm (L/s)>.
6. Design Inlet Pressure: <Insert psig (kPa)>.
7. Design Outlet Pressure Setting: <Insert psig (kPa)>.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; [flanged] <Insert type> for NPS 2-1/2 (DN 65) and larger.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Flo Fab Inc.
      c. ITT Corporation; Bell & Gossett Div.
      d. NIBCO Inc.
      e. TAC.
      f. TACO Incorporated.
      g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   2. Type: [Ball] [or] [Y-pattern globe] valve with two readout ports and memory-setting indicator.
   3. Body: [Brass] [or] [bronze].
   4. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
   5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. Flo Fab Inc.
c. ITT Corporation; Bell & Gossett Div.
d. NIBCO Inc.
e. TAC.
f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
      d. Crane Co.; Crane Valve Group; Stockham Div.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. NIBCO Inc.
      h. Red-White Valve Corp.

   2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
   4. Size: NPS 2 (DN 50) or smaller.
   5. Body: Copper alloy.
   6. Port: Standard or full port.
   7. Ball: Chrome-plated brass.
   8. Seats and Seals: Replaceable.
   9. End Connections: Solder joint or threaded.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Cash Acme; a division of Reliance Worldwide Corporation.
      c. Conbraco Industries, Inc.
      d. Honeywell International Inc.
      e. Legend Valve.
      f. Leonard Valve Company.
      g. Powers; a division of Watts Water Technologies, Inc.
h. Symmons Industries, Inc.
i. TACO Incorporated.
j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: <Insert deg F (deg C)>.
9. Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.
10. Valve Finish: [Chrome plated] [Rough bronze].

B. Primary, Thermostatic, Water Mixing Valves <Insert drawing designation if any>:

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

   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. Powers; a division of Watts Water Technologies, Inc.
   e. Symmons Industries, Inc.

3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Type: [Exposed-mounted] [Cabinet-type], thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: <Insert deg F (deg C)>.
9. Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.
10. Selected Valve Flow Rate at 45-psig (310-kPa) Pressure Drop: <Insert gpm (L/s)>.
11. Pressure Drop at Design Flow Rate: <Insert psig (kPa)>.
12. Valve Finish: [Chrome plated] [Polished, chrome plated] [Rough bronze].
13. Piping Finish: [Chrome plated] [Copper].

C. Manifold, Thermostatic, Water Mixing-Valve Assemblies <Insert drawing designation if any>:

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

   a. Leonard Valve Company.
b. Powers; a division of Watts Water Technologies, Inc.
c. Symmons Industries, Inc.

2. Description: Factory-fabricated, [cabinet-type] [exposed-mounted], thermostatically controlled, water mixing-valve assembly in [two] [three]-valve parallel arrangement.

3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.


6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.

7. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.

8. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.

9. Cabinet: Factory fabricated, stainless steel, for [recessed] [surface] mounting and with hinged, stainless-steel door.


11. Tempered-Water Setting: <Insert deg F (deg C)>.

12. Unit Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.

13. Unit Minimum Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.

14. Selected Unit Flow Rate at 45-psig (310-kPa) Pressure Drop: <Insert gpm (L/s)>.

15. Unit Pressure Drop at Design Flow Rate: <Insert psig (kPa)>.

16. Unit Tempered-Water Outlet Size: <Insert NPS (DN)> end connection.

17. Unit Hot- and Cold-Water Inlet Size: <Insert NPS (DN)> end connections.

18. Thermostatic Mixing Valve and Water Regulator Finish: [Chrome plated] [Polished, chrome plated] [Rough bronze].

19. Piping Finish: [Chrome plated] [Copper].

D. Photographic-Process, Thermostatic, Water Mixing-Valve Assemblies <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lawler Manufacturing Company, Inc.
   b. Leonard Valve Company.
   c. Powers; a division of Watts Water Technologies, Inc.
   d. Symmons Industries, Inc.

2. Standard: ASSE 1017, thermostatically controlled, water mixing valve made for precise, process-water temperature control.

3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.


5. Connections: Threaded inlets and outlet.

6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, thermometer, shutoff valve, and adjustable, temperature-control handle.

7. Cabinet: Factory fabricated, stainless steel, for surface mounting; with controls and thermometer mounted on front.

8. Tempered-Water Setting: <Insert deg F (deg C)>.
9. Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.
10. Tempered-Water Outlet Size: <Insert NPS (DN)> end connection.
11. Hot- and Cold-Water Inlet Size: <Insert NPS (DN)> end connections.

E. Individual-Fixture, Water Tempering Valves <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme; a division of Reliance Worldwide Corporation.
   b. Conbraco Industries, Inc.
   c. Honeywell International Inc.
   d. Lawler Manufacturing Company, Inc.
   e. Leonard Valve Company.
   f. Powers; a division of Watts Water Technologies, Inc.
   g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: <Insert deg F (deg C)>.
9. Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.

F. Primary Water Tempering Valves <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Holby Valve Co., Inc.

2. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
6. Inlets and Outlet: Threaded.
7. Selected Primary Water Tempering Valve Size: <Insert size>.
8. Tempered-Water Setting: <Insert deg F (deg C)>.
9. Tempered-Water Design Flow Rate: <Insert gpm (L/s)>.
10. Pressure Drop at Design Flow Rate: <Insert psig (kPa)>.
11. Tempered-Water Outlet Size: <Insert NPS (DN)> end connection.
12. Cold-Water Inlet Size: <Insert NPS (DN)> end connection.
13. Hot-Water Inlet Size: <Insert NPS (DN)> end connection.
2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers <Insert drawing designation if any>:
   1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
   2. Body: Bronze for NPS 2 (DN 50) 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 (DN 65) and larger.
   3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
   4. Screen: Stainless steel with round perforations unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 2 (DN 50) and Smaller: [0.020 inch (0.51 mm)] [0.033 inch (0.84 mm)] [0.062 inch (1.57 mm)] <Insert dimension>.
      b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [0.045 inch (1.14 mm)] [0.062 inch (1.57 mm)] [0.125 inch (3.18 mm)] <Insert dimension>.
      c. Strainers NPS 5 (DN 125) and Larger: [0.10 inch (2.54 mm)] [0.125 inch (3.18 mm)] [0.25 inch (6.35 mm)] <Insert dimension>.
   6. Drain: [Pipe plug] [Factory-installed, hose-end drain valve].

2.9 OUTLET BOXES

A. Clothes Washer Outlet Boxes <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Guy Gray Manufacturing Co., Inc.
      c. IPS Corporation.
      d. LSP Products Group, Inc.
      e. Oatey.
      f. Plastic Oddities.
      g. Symmons Industries, Inc.
      h. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
      j. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
   4. Faucet: Combination valve fitting or separate hot- and cold-water valve fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
   5. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
   6. Drain: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)] standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.

8. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes <Insert drawing designation if any>:

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

   b. IPS Corporation.
   c. LSP Products Group, Inc.
   d. Oatey.
   e. Plastic Oddities.

3. Material and Finish: [Enamed-steel or epoxy-painted-steel] [Enamed-steel, epoxy-painted-steel, or plastic] [Plastic] [Stainless-steel] box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.10 HOSE STATIONS

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

1. ARCHON Industries, Inc.
3. Cooney Brothers, Inc.
4. DynaFluid Ltd.
5. Leonard Valve Company.
6. Strahman Valves, Inc.
7. T & S Brass.

B. Single-Temperature-Water Hose Stations <Insert drawing designation if any>:

2. Cabinet: Stainless-steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
4. Body Material: Bronze[ with stainless-steel wetted parts].
5. Body Finish: Rough bronze[, chrome plated].
6. Mounting: [Wall, with reinforcement] [Floor, with stainless-steel pedestal].
7. Supply Fittings: [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] gate, globe, or ball valve and check valve and [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; [25 feet (7.6 m)] [50 feet (15 m)] long.


10. Vacuum Breaker:
    a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

C. Hot- and Cold-Water Hose Stations <Insert drawing designation if any>:

2. Faucet Type: [Blending] [Thermostatic mixing] valve.
5. Body Material: Bronze [with stainless-steel wetted parts].
6. Body Finish: Rough bronze [or chrome plated].
7. Mounting: [Wall, with reinforcement] [Floor, with stainless-steel pedestal].
8. Supply Fittings: Two [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] gate, globe, or ball valves and check valves and [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; [25 feet (7.6 m)] [50 feet (15 m)] long.
11. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

D. Cold-Water and Steam Hose Stations <Insert drawing designation if any>:

2. Faucet Type: [Blending] [Thermostatic mixing] valve.
5. Body Material: Bronze [with stainless-steel wetted parts].
6. Body Finish: Rough bronze [or chrome plated].
7. Mounting: [Wall, with reinforcement] [Floor, with stainless-steel pedestal].
8. Supply Fittings: Two [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] gate, globe, or ball valves and check valves and [NPS 1/2 (DN 15)] [NPS 3/4 (DN 20)] copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; [25 feet (7.6 m)] [50 feet (15 m)] long.
11. Vacuum Breaker:
a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.

b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.11 HOSE BIBBS

A. Hose Bibbs <Insert drawing designation if any>:

4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: [Rough bronze] [Chrome or nickel plated].
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: [Wheel handle] [Operating key].
13. Operation for Finished Rooms: [Wheel handle] [Operating key].
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.12 WALL HYDRANTS

A. Nonfreeze Wall Hydrants <Insert drawing designation if any>:

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


2. Standard: ASME A112.21.3M for [concealed] [exposed]-outlet, self-draining wall hydrants.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: [Polished nickel bronze] [Chrome plated] <Insert finish>.
11. Nozzle and Wall-Plate Finish: [Polished nickel bronze] [Rough bronze].
12. Operating Keys(s): [One] [Two] with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Prier Products, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products.
   f. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M for [concealed] [exposed]-outlet, self-draining wall hydrants.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: [Polished nickel bronze] [Chrome plated].
10. Vacuum Breaker:
   a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Keys(s): [One] [Two] with each wall hydrant.

C. Moderate-Climate Wall Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Prier Products, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products.
g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M for [concealed] [exposed]-outlet, self-draining wall hydrants.
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet:
   a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: [Polished nickel bronze] [Chrome plated].
9. Outlet:
   a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: [Polished nickel bronze] [Rough bronze].
11. Operating Keys(s): [One] [Two] with each wall hydrant.

D. Vacuum Breaker Wall Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arrowhead Brass Products.
   b. Mansfield Plumbing Products LLC.
   d. Prier Products, Inc.
   f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: [Type A, for automatic draining with hose removed or ]Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
6. Operation: [Loose key] [or] [wheel handle].
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).

2.13 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Murdock-Super Secur; a division of Acorn Engineering Company.
   d. Prier Products, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products.
   h. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   i. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
   j. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, concealed-outlet ground hydrant with box.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: [Standard] [Deep] pattern with cover.
10. Box and Cover Finish: [Rough] [Polished nickel] bronze.
11. Operating Key(s): [One] [Two] with each ground hydrant.

2.14 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Prier Products, Inc.
   c. Simmons Manufacturing Co.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products.
g. Woodford Manufacturing Company; a division of WCM Industries, Inc.

h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:
   a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.

11. Operating Key(s): [One] [Two] with each loose-key-operation wall hydrant.

B. Nonfreeze, Nondraining-Type Post Hydrants <Insert drawing designation if any>:

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

2. Operation: Lever-piston operating mechanism and nondraining water-storage reservoir, designed without drain.
3. Length: As required for burial of valve below frost line.
5. Outlet:
   a. Garden-hose thread complying with ASME B1.20.7 on outlet.

C. Freeze-Resistant Sanitary Yard Hydrants <Insert drawing designation if any>:

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

2. Standard: ASSE 1057, Type 5 for nondraining hydrants.
3. Operation: Wheel handle.
4. Head: Copper alloy, with pail hook.
5. Inlet: NPS 3/4-inch (DN 20) threaded inlet and inlet nozzle, galvanized-steel riser, and venturi.
7. Vacuum Breaker:
   a. Removable hose-connection backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7 on outlet for field installation.

2.15 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves <Insert drawing designation if any>:

2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
8. Inlet: Threaded or solder joint.

B. Gate-Valve-Type, Hose-End Drain Valves <Insert drawing designation if any>:

2. Pressure Rating: Class 125.
5. Inlet: NPS 3/4 (DN 20) 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 <Insert drawing designation if any>:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.16 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products.
2.17 AIR VENTS

A. Bolted-Construction Automatic Air Vents <Insert drawing designation if any>:
   1. Body: Bronze.
   2. Pressure Rating and Temperature: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
   3. Float: Replaceable, corrosion-resistant metal.
   5. Size: [NPS 3/8 (DN 10)] [NPS 1/2 (DN 15)] minimum inlet.

B. Welded-Construction Automatic Air Vents <Insert drawing designation if any>:
   2. Pressure Rating: 150-psig (1035-kPa) minimum pressure rating.
   3. Float: Replaceable, corrosion-resistant metal.

2.18 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device <Insert drawing designation if any>:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIFAB, Inc.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Company, Inc.
      e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   3. Pressure Rating: 125 psig (860 kPa) minimum.
   5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
   6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) 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 <Insert drawing designation if any>:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:


2.19 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Precision Plumbing Products, Inc.

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing.
4. Cabinet: [Recessed] [Surface]-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

7. Number Outlets: [Four] [Six] [Eight].
8. Size Outlets: [NPS 1/2 (DN 15)] [NPS 5/8 (DN 18)].

2.20 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section 220523 "General-Duty Valves for Plumbing Piping."

B. CPVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer LLC; GF Piping Systems.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. IPEX.
2. Description:
   b. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).
   c. Body Material: CPVC.
   d. Body Design: Union type.
   e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, [socket] [or] [threaded].
   f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, [socket] [socket or threaded] [threaded] [flanged].
   g. Ball: CPVC; full port.
   h. Seals: PTFE or EPDM-rubber O-rings.
   i. Handle: Tee shaped.

C. PVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer LLC; GF Piping Systems.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. IPEX.
   g. Jomar International.
   h. KBI Company.
   i. Legend Valve.
   k. NIBCO Inc.
   l. Spears Manufacturing Company.
   m. Thermoplastic Valves Inc.

2. Description:
   b. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).
   c. Body Material: PVC.
   d. Body Design: Union type.
   e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, [socket] [or] [threaded].
   f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, [socket] [socket or threaded] [threaded] [flanged].
   g. Ball: PVC; full port.
   h. Seals: PTFE or EPDM-rubber O-rings.
D. CPVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. KBI Company.
   d. Legend Valve.
   e. NIBCO Inc.
   f. Spears Manufacturing Company.
   g. Thermoplastic Valves Inc.

2. Description:
   b. Pressure Rating and Temperature: \([125 \text{ psig} \ (860 \text{ kPa}) \ [150 \text{ psig} \ (1035 \text{ kPa})]\) at 73 deg F (23 deg C).
   c. Body Material: CPVC.
   d. Body Design: Non-union type.
   e. End Connections: Socket or threaded.
   f. Ball: CPVC; full or reduced port.
   g. Seals: PTFE or EPDM-rubber O-rings.
   h. Handle: Tee shaped.

E. PVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer LLC; GF Piping Systems.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. IPEX.
   g. Jomar International.
   h. KBI Company.
   i. Legend Valve.
   k. NIBCO Inc.
   l. Spears Manufacturing Company.
   m. Thermoplastic Valves Inc.

2. Description:
   b. Pressure Rating and Temperature: \([125 \text{ psig} \ (860 \text{ kPa}) \ [150 \text{ psig} \ (1035 \text{ kPa})]\) at 73 deg F (23 deg C).
c. Body Material: PVC.

d. Body Design: Non-union type.

e. End Connections: Socket or threaded.

f. Ball: PVC; full or reduced port.

g. Seals: PTFE or EPDM-rubber O-rings.

h. Handle: Tee shaped.

F. CPVC Butterfly Valves:

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


   b. Hayward Flow Control Systems; Hayward Industrial Products, Inc.

   c. NIBCO Inc.

   d. Spears Manufacturing Company.

   e. Thermoplastic Valves Inc.

2. Description:

   a. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).

   b. Body Material: CPVC.

   c. Body Design: Lug or wafer type.

   d. Seat: EPDM rubber.

   e. Seals: PTFE or EPDM-rubber O-rings.

   f. Disc: CPVC.

   g. Stem: Stainless steel.

   h. Handle: Lever.

G. PVC Butterfly Valves:

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

   a. American Valve, Inc.

   b. Asahi/America.

   c. Colonial Engineering, Inc.

   d. Georg Fischer LLC; GF Piping Systems.

   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.

   f. IPEX.

   g. Legend Valve.

   h. NIBCO Inc.

   i. Spears Manufacturing Company.

   j. Thermoplastic Valves Inc.

2. Description:

   a. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).

   b. Body Material: PVC.
c. Body Design: Lug or wafer type.
d. Seat: EPDM rubber.
e. Seals: PTFE or EPDM-rubber O-rings.
f. Disc: PVC.
g. Stem: Stainless steel.
h. Handle: Lever.

H. CPVC Ball Check Valves:

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

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. NIBCO Inc.
h. Spears Manufacturing Company.
i. Thermoplastic Valves Inc.

2. Description:

a. Pressure Rating and Temperature: \[125 \text{ psig (860 kPa)}\] \[150 \text{ psig (1035 kPa)}\] at 73 deg F (23 deg C).
b. Body Material: CPVC.
c. Body Design: Union-type ball check.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, [socket] or [threaded].
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, [socket] or [threaded] [threaded] [flanged].
f. Ball: CPVC.
g. Seals: EPDM- or FKM-rubber O-rings.

I. PVC Ball Check Valves:

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

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. Legend Valve.
h. NIBCO Inc.
i. Spears Manufacturing Company.
j. Thermoplastic Valves Inc.
2. Description:
   a. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).
   b. Body Material: PVC.
   c. Body Design: Union-type ball check.
   d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, [socket] [or] [threaded].
   e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, [socket] [socket or threaded] [threaded] [flanged].
   f. Ball: PVC.
   g. Seals: EPDM- or FKM-rubber O-rings.

J. CPVC Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Spears Manufacturing Company.

   2. Description:
      a. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).
      b. Body Material: CPVC.
      c. Body Design: Nonrising stem.
      d. End Connections for Valves NPS 2 (DN 50) and Smaller: [Socket] [or] [threaded].
      e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [Socket] [Socket or threaded] [Threaded] [Flanged].
      f. Gate and Stem: Plastic.
      g. Seals: EPDM rubber.
      h. Handle: Wheel.

K. PVC Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Asahi/America.
      b. Georg Fischer LLC; GF Piping Systems.
      c. KBI Company.
      d. Spears Manufacturing Company.

   2. Description:
      a. Pressure Rating and Temperature: [125 psig (860 kPa)] [150 psig (1035 kPa)] at 73 deg F (23 deg C).
      b. Body Material: PVC.
      c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: [Socket] [or] [threaded].
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [Socket] [Socket or threaded] [Threaded] [Flanged].
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

2.21 FLEXIBLE CONNECTORS

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

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex Universal Metal Hose; a Hyspan company.

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 (1380 kPa)] [250 psig (1725 kPa)].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) 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 (1380 kPa)] [250 psig (1725 kPa)].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.22 WATER METERS

A. Displacement-Type Water Meters:

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

a. AALIANT; a Venture Measurement product line ABB Badger Meter, Inc.
b. Carlon Meter.
c. Mueller Co, Ltd.; a subsidiary of Mueller Water Products Inc.
d. Schlumberger Limited; Water Services.
e. Sensus.

2. Description:

b. Pressure Rating: 150-psig (1035-kPa) working pressure.
c. Body Design: Nutating disc; totalization meter.
d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
e. Case: Bronze.
f. End Connections: Threaded.

B. Turbine-Type Water Meters:

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

a. AALIANT; a Venture Measurement product line.
b. ABB.
c. Badger Meter, Inc.
d. Hays Fluid Controls.
e. Master Meter, Inc.
f. McCrometer, Inc.
g. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
h. Schlumberger Limited; Water Services.
i. SeaMetrics Inc.
j. Sensus.

2. Description:

b. Pressure Rating: [150-psig (1035-kPa)] <Insert value> working pressure.
c. Body Design: Turbine; totalization meter.
d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
e. Case: Bronze.
f. End Connections for Meters NPS 2 (DN 50) and Smaller: Threaded.
g. End Connections for Meters NPS 2-1/2 (DN 65) and Larger: Flanged.

C. Compound-Type Water Meters:

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

a. ABB.
b. Badger Meter, Inc.
c. Master Meter, Inc.
d. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
e. Schlumberger Limited; Water Services.
f. Sensus.
2. Description:
   b. Pressure Rating: **150-psig (1035-kPa)** working pressure.
   c. Body Design: With integral mainline and bypass meters; totalization meter.
   d. Registration: In **gallons (liters)** or **cubic feet (cubic meters)** as required by utility company.
   e. Case: Bronze.

D. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

E. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

### 2.23 HOT WATER DISPENSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Insinkerator, model H-778
   2. Description
      a. 100 cups of 200 degree F water per hour capacity
      b. Twist-handle operation
      c. Chrome plated faucet
      d. Elevated spout
      e. 2/3 gallon stainless steel tank construction
      f. 120 volt, 1300 watt, 10.8 amp.

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**PART 3 - EXECUTION**

#### 3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves[ **and bypass with memory-stop balancing valve**]. Install pressure gages on inlet and outlet.
C. Install water-control valves with inlet and outlet shutoff valves [and bypass with globe valve]. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each [control valve] [water pressure-reducing valve] [solenoid valve] [and] [pump].

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Install ground hydrants with 1 cu. yd. (0.75 cu. m) of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

J. Install draining-type post hydrants with 1 cu. yd. (0.75 cu. m) of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. (0.03 cu. m) of concrete block at grade.

K. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

L. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

M. Install water-hammer arresters in water piping according to PDI-WH 201.

N. Install air vents at high points of water piping. [Install drain piping and discharge onto floor drain.]

O. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

P. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

Q. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
5. Carbonated-beverage-machine backflow preventers.
7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
14. Primary water tempering valves.
15. Outlet boxes.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each [pressure vacuum breaker] [reduced-pressure-principle backflow preventer] [double-check, backflow-prevention assembly] [and] [double-check, detector-assembly backflow preventer] according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119
SECTION 221122 - FACILITY NATURAL-GAS 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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 150 psig (1035 kPa) minimum unless otherwise indicated.
2. Service Regulators: 100 psig (690 kPa) minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: [5 psig (34.5 kPa)] [10 psig (69 kPa)] [20 psig (138 kPa)] [65 psig (450 kPa)].

B. Natural-Gas System Pressure within Buildings: [0.5 psig (3.45 kPa) or less] [More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa)] [More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa)].
C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars.
6. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot (1:50).
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.
1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For [motorized gas valves] [pressure regulators] [and] [service meters] to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code - Steel.”

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Cleveland Clinic or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify the Cleveland Clinic no fewer than seven days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without the Cleveland Clinic’s written permission.
1.11 COORDINATION

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

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   b. End Connections: Threaded or butt welding to match pipe.
   c. Lapped Face: Not permitted underground.
   e. Bolts and Nuts: ASME B18.2.1, carbon steel above ground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
   a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) [Dresser Piping Specialties; Division of Dresser, Inc.]
      2) [Smith-Blair, Inc.]
   b. [Stainless-steel] [Steel] flanges and tube with epoxy finish.
   c. Buna-nitrile seals.
   d. [Stainless-steel] [Steel] bolts, washers, and nuts.
   e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Parker Hannifin Corporation; Parflex Division.
      b. Titeflex.
      c. Gastite.

   3. Coating: PE with flame retardant.
      a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
         1) Flame-Spread Index: 25 or less.
         2) Smoke-Developed Index: [50] [450] or less.

   4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
   5. Striker Plates: Steel, designed to protect tubing from penetrations.
   6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
   7. Operating-Pressure Rating: 5 psig (34.5 kPa).

C. Drawn-Temper Copper Tube: Comply with [ASTM B 88, Type K (ASTM B 88M, Type A)]
   [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 837, Type G].

      b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

   3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.

D. Annealed-Temper Copper Tube: Comply with [ASTM B 88, Type K (ASTM B 88M,
   Type A)] [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 837, Type G].

      a. Copper fittings with long nuts.
b. Metal-to-metal compression seal without gasket.
c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.

E. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. [Vent casing aboveground.]
   c. Aboveground Portion: PE transition fitting.
   d. Outlet shall be threaded or flanged or suitable for welded connection.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or flanged or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Lyall, R. W. & Company, Inc.
      2) Mueller Co.; Gas Products Div.
      3) Perfection Corporation; a subsidiary of American Meter Company.
   b. PE body with molded-in, stainless-steel support ring.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
      1) [Lyall, R. W. & Company, Inc.](#)
      2) [Mueller Co.; Gas Products Div.](#)
      3) [Perfection Corporation; a subsidiary of American Meter Company.](#)
   b. Fiber-reinforced plastic body.
   c. PE body tube.
   d. Buna-nitrile seals.
   e. Acetal collets.
   f. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
      1) [Dresser Piping Specialties; Division of Dresser, Inc.](#)
      2) [Smith-Blair, Inc.](#)
   b. [Stainless-steel] [Steel] flanges and tube with epoxy finish.
   c. Buna-nitrile seals.
   d. [Stainless-steel] [Steel] bolts, washers, and nuts.
   e. Factory-installed anode for steel-body couplings installed underground.

### 2.2 PIPING SPECIALTIES

#### A. Appliance Flexible Connectors:
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: **0.5 psig (3.45 kPa)**.
8. Maximum Length: **72 inches (1830 mm.)**

#### B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.
C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

D. Basket Strainers:
1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

E. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig (5170 kPa).

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS
A. Joint Compound and Tape: Suitable for natural gas.
C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES
A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: **150 psig (1035 kPa)**.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: **150 psig (1035 kPa)**.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   c. Lyall, R. W. & Company, Inc.
   e. Perfection Corporation; a subsidiary of American Meter Company.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
8. CWP Rating: **600 psig (4140 kPa)**.
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Three-Piece, Full-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
BrassCraft Manufacturing Company; a Masco company.
c. Lyall, R. W. & Company, Inc.
e. Perfection Corporation; a subsidiary of American Meter Company.

3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WO G" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

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

a. Lee Brass Company.
c. Perfection Corporation; a subsidiary of American Meter Company.
d. Conbraco Industries, Inc.; Apollo Div.

5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

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

c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WO G" indicated on valve body.


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   d. Milliken Valve Company.
   e. Mueller Co.; Gas Products Div.
2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WO G" indicated on valve body.

I. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kerotest Manufacturing Corp.
   b. Lyall, R. W. & Company, Inc.
   c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig (552 kPa).
8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.
J. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASCO Power Technologies, LP; Division of Emerson.
   b. Dungs, Karl, Inc.
   c. Eaton Corporation; Controls Div.
   d. Eclipse Combustion, Inc.
   e. Honeywell International Inc.
   f. Johnson Controls.

2. Body: Brass or aluminum.
5. Normally closed.
7. [Electrical] [Mechanical] operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASCO Power Technologies, LP; Division of Emerson.
   b. Dungs, Karl, Inc.
   c. Eclipse Combustion, Inc.
   d. Goyen Valve Corp.; Tyco Environmental Systems.
   e. Magnatrol Valve Corporation.
   f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
   g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   
a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig (34.5 kPa).
5. Nitrile-rubber valve washer.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   
a. Pacific Seismic Products, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: [0.5 psig (3.45 kPa)] [7 psig (48 kPa)] [60 psig (414 kPa)].
4. Cast-aluminum body with stainless-steel internal parts.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   d. Invensys.
   e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: \[2 \text{ psig (13.8 kPa)} \] \[5 \text{ psig (34.5 kPa)} \] \[10 \text{ psig (69 kPa)} \].


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.

5. Seat Disc: Nitrile rubber.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: \[1 \text{ psig (6.9 kPa)} \] \[2 \text{ psig (13.8 kPa)} \] \[5 \text{ psig (34.5 kPa)} \].

2.8 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with [ANSI B109.1] [ANSI B109.2].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Invensys.

3. Connections: Steel threads.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].
8. Meter Case and Index: Tamper resistant.
10. Maximum Inlet Pressure: 100 psig (690 kPa).
11. Pressure Loss: Maximum [0.5-inch wg (124 Pa)] [2.0-inch wg (498 Pa)].
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Meter Company.
   b. Invensys.


6. Compensation: Continuous temperature and pressure.

7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].

8. Tamper resistant.


10. Maximum Inlet Pressure: 100 psig (690 kPa).

11. Accuracy: Maximum plus or minus 2.0 percent.

C. Turbine Meters: Comply with ASME MFC-4M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Meter Company.
   b. Invensys.

2. Housing: Cast iron or welded steel.

3. Connection Threads or Flanges: Steel.

4. Turbine: Aluminum or plastic.


6. Compensation: Continuous temperature and pressure.

7. Meter Index: [Cubic feet] [Liters] [Cubic feet and liters].

8. Tamper resistant.


10. Maximum Inlet Pressure: 100 psig (690 kPa).

11. Accuracy: Maximum plus or minus 2.0 percent.

D. Service-Meter Bars:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Lyall, R. W. & Company, Inc.
   e. Mueller Co.; Gas Products Div.
   f. Perfection Corporation; a subsidiary of American Meter Company.

2. Malleable- or cast-iron frame for supporting service meter.

3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

E. Service-Meter Bypass Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Williamson, T. D., Inc.

2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

2.9 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:
   b. Central Plastics Company.
   d. Jomar International Ltd.
   e. Matco-Norca, Inc.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company.

2. Description:
   b. Pressure Rating: \([125 \text{ psig (860 kPa) minimum at } 180 \text{ deg F (82 deg C)}] [150 \text{ psig (1035 kPa)}] [250 \text{ psig (1725 kPa)}].\)
   c. 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:
   b. Central Plastics Company.
   c. Matco-Norca, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Wilkins; a Zurn company.
2. Description:
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: \([125 \text{ psig} (860 \text{ kPa}) \text{ minimum at } 180 \text{ deg F} (82 \text{ deg C})]\) [\(150 \text{ psig} (1035 \text{ kPa})\)] [\(175 \text{ psig} (1200 \text{ kPa})\)] [\(300 \text{ psig} (2070 \text{ kPa})\)].
   d. 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.
      d. Pipeline Seal and Insulator, Inc.
   2. Description:
      a. Nonconducting materials for field assembly of companion flanges.
      b. Pressure Rating: \(150 \text{ psig} (1035 \text{ kPa})\).
      c. Gasket: Neoprene or phenolic.
      d. Bolt Sleeves: Phenolic or polyethylene.
      e. Washers: Phenolic with steel backing washers.

2.10 LABELING AND IDENTIFYING
   A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
   A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
B. Inspect natural-gas piping according to [NFPA 54] [the International Fuel Gas Code] to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with [NFPA 54] [the International Fuel Gas Code] requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with [NFPA 54] [the International Fuel Gas Code] for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with [NFPA 54] [the International Fuel Gas Code] for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
   a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:
   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground[ , on concrete bases ].

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
   2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
   4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
   5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
   1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
   2. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
   3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
   4. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

E. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. **NPS 3/8 (DN 10)**: Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).

2. **NPS 1/2 (DN 15)**: Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).

3. **NPS 3/4 (DN 20) and Larger**: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

**3.9 CONNECTIONS**

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

**3.10 LABELING AND IDENTIFYING**

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

**3.11 PAINTING**

A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. **Alkyd System: MPI EXT 5.1D.**
   c. Topcoat: Exterior alkyd enamel [(flat) [(semigloss)] [(gloss)].
   d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].
C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
   c. Topcoat: Interior latex [(flat)] [(low sheen)] [(eggshell)] [(satin)] [(semigloss)] [(gloss)].
   d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].

2. Alkyd System: MPI INT 5.1E.
   c. Topcoat: Interior alkyd [(flat)] [(eggshell)] [(semigloss)] [(gloss)].
   d. Color: Comply with [NFPA 54] [the International Fuel Gas Code].

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base[ according to seismic codes at Project].

   1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in [Section 033000 "Cast-in-Place Concrete." ] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

   1. Test, inspect, and purge natural gas according to [NFPA 54] [the International Fuel Gas Code] and authorities having jurisdiction.
C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Wrap and coat pipe and fittings with protective coating for steel piping.
3. [Annealed] [Drawn]-temper copper tube with wrought-copper fittings and brazed joints. Coat and sleeve pipe and fittings with protective coating for copper tubing.

B. Aboveground natural-gas piping shall be one of the following:

2. Steel pipe with wrought-steel fittings and welded joints. Paint with corrosion prevention paint.
3. [Annealed] [Drawn]-temper copper tube with wrought-copper fittings and brazed or flared joints. Provide damage prevention fencing around piping.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and [brazed] [flared] joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller limited to specialty equipment shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, copper tube with wrought-copper fittings and [brazed] [flared] joints.
3. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
   1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
   2. Annealed-temper, copper tube with wrought-copper fittings and [brazed] [flared] joints.
   3. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with steel welding fittings and welded joints.
   3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.18 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG (34.5 kPa)

A. Aboveground Piping: Maximum operating pressure more than 5 psig (34.5 kPa).
B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.

C. Aboveground, distribution piping shall be one of the following:
   1. Steel pipe with steel welding fittings and welded joints.
   2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

D. Underground, below building, piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.19 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:
   1. PE valves.
   2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
   3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, [lubricated] [nonlubricated] plug valves.

3.20 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.
   3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, [nonlubricated] [lubricated] plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123
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.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, without amendments, Section 7 - "Service Water Heating."

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, SEPARATELY COUPLED CENTRIFUGAL PUMPS

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

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
6. Bearings: Oil-lubricated; bronze-journal or ball type.
7. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and [resiliently] [or] [rigidly] mounted to pump casing.
E. Capacities and Characteristics:

1. Capacity: \(<\text{Insert gpm (L/s)}\>.
2. Total Dynamic Head: \(<\text{Insert feet (kPa)}\>.
4. Impeller Material: [ASTM B 584, cast bronze] [ASTM B 584, cast bronze or stainless steel] [Stainless steel].
5. Minimum Working Pressure: [125 psig (860 kPa)] [175 psig (1200 kPa)].
7. Inlet and Outlet Size: \(<\text{Insert NPS (DN)}\>.
8. Pump Speed: \(<\text{Insert rpm}\>.
9. Pump Control: [Pressure switch] [Thermostat] [Timer].
11. Electrical Characteristics:
    a. Volts: [120] [240].
    b. Phases: [Single] [Three].
    c. Hertz: 60.
    d. Full-Load Amperes: \(<\text{Insert value}\>.
    e. Minimum Circuit Ampacity: \(<\text{Insert value}\>.
    f. Maximum Overcurrent Protection: \(<\text{Insert value}\> A.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

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

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

E. Capacities and Characteristics:

1. Capacity: <Insert gpm (L/s)>.
2. Total Dynamic Head: <Insert feet (kPa)>.
4. Impeller Material: [ASTM B 584, cast bronze] [ASTM B 584, cast bronze or stainless steel] [Stainless steel].
7. Inlet and Outlet Size: <Insert NPS (DN)>.
8. Pump Control: [Pressure switch] [Thermostat] [Timer].
11. Electrical Characteristics:
   a. Volts: [120] [240].
   b. Phases: [Single] [Three].
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert value> A.

2.3 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

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

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.

C. Pump Construction:

1. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.[ Include pump manufacturer's base attachment for mounting pump on concrete base.]
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: [Stainless-steel or steel] [Stainless-steel] shaft, with copper-alloy shaft sleeve.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.

D. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.

E. Capacities and Characteristics:

1. Capacity: <Insert gpm (L/s)>.
2. Total Dynamic Head: <Insert feet (kPa)>.
4. Impeller Material: [ASTM B 584, cast bronze] [ASTM B 584, cast bronze or stainless steel] [Stainless steel].
5. Minimum Operating Pressure: 175 psig (1200 kPa).
7. Inlet and Outlet Size: <Insert NPS (DN)>.
8. Pump Control: [Pressure switch] [Thermostat] [Timer].
11. Electrical Characteristics:

   a. Volts: [120] [240].
   b. Phases: [Single] [Three].
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert value> A.

2.4 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.

2.5 CONTROLS

A. Pressure Switches: Electric, adjustable for control of water-supply 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: [24 V, ac] [120 V, ac].
6. Settings: Start pump at <Insert pressure> and stop pump at <Insert pressure>.

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 125 deg F (10 to 52 deg C)] [65 to 200 deg F (18 to 93 deg C)] [100 to 240 deg F (38 to 116 deg C)].
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: [24 V, ac] [120 V, ac].
7. Settings: Start pump at [105 deg F (41 deg C)] [110 deg F (43 deg C)] [115 deg F (46 deg C)] and stop pump at [120 deg F (49 deg C)] [125 deg F (52 deg C)].

C. 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.
4. Enclosure: NEMA 250, Type 4X.
5. Operation of Pump: On or off.
6. Transformer: Provide if required.
7. Power Requirement: [24-V ac] [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 of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION
A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, [separately coupled] [and] [close-coupled] centrifugal pumps with shaft(s) horizontal.

D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.

E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using [elastomeric pads] [elastomeric mounts] [restrained spring isolators]. Comply with requirements for concrete base specified in [Section 033000 "Cast-in-Place Concrete."],[Section 033053 "Miscellaneous Cast-in-Place Concrete."]

1. Minimum Deflection: [1/4 inch (6 mm)] [1 inch (25 mm)].
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

F. Install continuous-thread hanger rods and [spring hangers] [spring hangers with vertical-limit stop] of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.

2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

G. Install pressure switches in water supply piping.

H. Install thermostats in hot-water return piping.

I. Install timers on wall in engineer's office.

J. Install time-delay relays in piping between water heaters and hot-water storage tanks.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

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."

2. Install cutoff valve and strainer on suction side of each pump, and check, cutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
3. Install pressure gage[ and snubber] at suction of each pump and pressure gage[ and snubber] at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

D. Connect [pressure switches,] [thermostats,] [time-delay relays,] [and] [timers] to pumps that they control.

E. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

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

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set [pressure switches,] [thermostats,] [timers,] [and] [time-delay relays] for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:
   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.
C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123
SECTION 221316 - SANITARY WASTE AND VENT 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. Pipe, tube, and fittings.
   2. Specialty pipe fittings.
   3. Encasement for underground metal piping.

B. Related Sections:
   1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
   2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
   3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

C. Products to be American made.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   2. Waste, Force-Main Piping: 100 psig (690 kPa).

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.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

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


1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Cleveland Clinic or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager and Cleveland Clinic Plumbing Supervisor no fewer than seven days in advance of proposed interruption of sanitary waste service.
   2. Do not proceed with interruption of sanitary waste service without Cleveland Clinic Plumbing Supervisor’s written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

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

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Clamp-All Corp. - only 120 lb.
   b. Mission Rubber Company; a division of MCP Industries, Inc.


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 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight Class. Include square-cut-grooved or threaded ends matching joining method.


C. Steel Pipe Pressure Fittings:


D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International; a subsidiary of Mueller Water Products, Inc.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products.
   d. 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 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.6 DUCTILE-IRON PIPE AND FITTINGS

A. 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.


3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. 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.


C. Ductile-Iron, Grooved-Joint Piping:


2. Ductile-Iron-Pipe Appurtenances:

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

      1) Anvil International.
      2) Shurjoint Piping Products.
      3) Star Pipe Products.
      4) Victaulic Company.

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.

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2) Fernco Inc.
      3) Mission Rubber Company; a division of MCP Industries, Inc.
      4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   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. Sleeve Materials:
      2) For Dissimilar Pipes: ASTM D 5926, material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2) Mission Rubber Company; a division of MCP Industries, Inc.
   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.
5. Pressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
c.  Description:  Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d.  Center-Sleeve Material:  [Manufacturer's standard] [Carbon steel] [Stainless steel] [Ductile iron] [Malleable 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.  Manufacturers:  Subject to compliance with requirements, provide products by one of the following:

      1)  Capitol Manufacturing Company.
      2)  Central Plastics Company.
      3)  Hart Industries International, Inc.
      4)  Jomar International Ltd.
      5)  Matco-Norca, Inc.
      7)  Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      8)  Wilkins; a Zurn company.

   b.  Description:

      1)  Standard:  ASSE 1079.
      2)  Pressure Rating:  [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [250 psig (1725 kPa)].
      3)  End Connections:  Solder-joint copper alloy and threaded ferrous.

3.  Dielectric Flanges:

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

      1)  Capitol Manufacturing Company.
      2)  Central Plastics Company.
      3)  Matco-Norca, Inc.
4)  **Watts Regulator Co.; a division of Watts Water Technologies, Inc.**
5)  **Wilkins; a Zurn company.**

b.  **Description:**

1)  Standard: ASSE 1079.
2)  Factory-fabricated, bolted, companion-flange assembly.
3)  Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)]
   [150 psig (1035 kPa)] [175 psig (1200 kPa)] [300 psig (2070 kPa)].
4)  End Connections: Solder-joint copper alloy and threaded ferrous; threaded
   solder-joint copper alloy and threaded ferrous.

4.  **Dielectric-Flange Insulating Kits:**

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

1)  **Advance Products & Systems, Inc.**
2)  **Calpico, Inc.**
3)  **Central Plastics Company.**
4)  **Pipeline Seal and Insulator, Inc.**

b.  **Description:**

1)  Nonconducting materials for field assembly of companion flanges.
2)  Pressure Rating: [150 psig (1035 kPa)] <Insert pressure>.
3)  Gasket: Neoprene or phenolic.
4)  Bolt Sleeves: Phenolic or polyethylene.
5)  Washers: Phenolic with steel backing washers.

5.  **Dielectric Nipples:**

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

1)  **Elster Perfection.**
2)  **Grinnell Mechanical Products.**
3)  **Matco-Norca, Inc.**
4)  **Precision Plumbing Products, Inc.**
5)  **VicuLac Company.**

b.  **Description:**

1)  Standard: IAPMO PS 66
2)  Electroplated steel nipple.
3)  Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4)  End Connections: Male threaded or grooved.
5)  Lining: Inert and noncorrosive, propylene.
2.8 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: [Linear low-density polyethylene film of \textit{0.008-inch (0.20-mm)}] \textit{or} \textit{[high-density, cross-laminated polyethylene film of \textit{0.004-inch (0.10-mm)}]} minimum thickness.

C. Form: \textit{[Sheet]} \textit{or} \textit{[tube]}

D. Color: \textit{[Black]} \textit{or} \textit{[natural]}

PART 3 - EXECUTION

3.1 EARTH MOVING

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

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping 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. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2-1/2 (DN 65) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 2-1/2 (DN 65) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
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."

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 stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

Q. Install engineered soil and waste drainage and vent piping systems as follows:


R. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

S. Install force mains at elevations indicated.

T. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping. 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 drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

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


C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. 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.
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.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: [Unshielded] [Shielded], nonpressure transition couplings.
4. In Underground Force Main Piping:
   a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
   b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [nipples] [unions].
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [flanges] [flange kits] [nipples].
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
3. Install gate valve for piping NPS 2-1/2 (DN 65) 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."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive 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 (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) 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 (10-mm) 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
   5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
   6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 and NPS 8 (DN 150 and DN 200): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 10 and NPS 12 (DN 250 and DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 (DN 100): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

K. Install supports for vertical stainless-steel piping every 10 feet (3 m).

L. Support piping and tubing not listed above according to MSS SP-69 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 drainage and vent piping to the following:

1. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
2. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
3. Install horizontal backwater valves [with cleanout cover flush with floor] [in pit with pit cover flush with floor].
4. Comply with requirements for [backwater valves] [cleanouts] [and] [drains] specified in Section 221319 "Sanitary Waste Piping Specialties."
5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.
E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) 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. 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 drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain
constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

E. 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. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. 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.

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, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.


4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.

5. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
   4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
   5. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
   4. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
   1. [Extra Heavy] [Service] class, cast-iron soil piping; [gaskets; and gasketed] [calking materials; and calked] joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
   3. Stainless-steel pipe and fittings gaskets, and gasketed joints.
   4. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
   1. [Extra Heavy] [Service] class, cast-iron soil piping; [gaskets; and gasketed] [caking materials; and caked] joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
   3. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) shall be any of the following:
   1. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) shall be any of the following:
   1. Galvanized-steel pipe, pressure fittings, and threaded joints.
2. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Ductile-iron, push-on-joint piping and push-on joints.
3. Ductile-iron, grooved-joint piping and grooved joints.
4. Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger shall be any of the following:
1. Ductile-iron, mechanical-joint piping and mechanical joints.
2. Ductile-iron, push-on-joint piping and push-on joints.
3. Ductile-iron, grooved-joint piping and grooved joints.
4. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221316
SECTION 221319 - SANITARY WASTE 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. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Channel drainage systems.
6. Air-admittance valves.
7. Roof flashing assemblies.
8. Through-penetration firestop assemblies.
10. Flashing materials.
11. FOG disposal systems.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 224300 "Medical Plumbing Fixtures" for plaster sink interceptors.
3. Section 334100 "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.3 DEFINITIONS


B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.
E. PE: Polyethylene plastic.
F. PP: Polypropylene plastic.
G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. FOG disposal systems.
2. Grease interceptors.
4. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.


1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that [FOG disposal systems,] [grease interceptors,] [grease removal devices,] [oil interceptors,] accessories, and components will withstand seismic forces defined in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.
1.7 QUALITY ASSURANCE

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

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in [Section 033000 "Cast-in-Place Concrete." ] [Section 033053 "Miscellaneous Cast-in-Place Concrete." ]

B. Coordinate size and location of roof penetrations.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cultures: Provide 1-gal. (3.8-L) bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than 2 1-gal. (3.8-L) bottles.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves <Insert drawing designation if any>: 

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


b. MIFAB, Inc.


d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.

f. Zurn Plumbing Products Group; Specification Drainage Operation.


3. Size: Same as connected piping.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: [Hub and spigot] [Hub and spigot or hubless] [Hubless].
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
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. Drain-Outlet Backwater Valves <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

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

2.2 CLEANOUTS

A. Exposed Metal Cleanouts <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
   g. Josam Company; Blucher-Josam Div.

2. Standard: [ASME A112.36.2M for cast iron] [ASME A112.3.1 for stainless steel] for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: [Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] [Stainless-steel tee with side cleanout] as required to match connected piping.
5. Closure: [Countersunk] [Countersunk or raised-head] [Raised-head], [brass] [cast-iron] [plastic] plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts <Insert drawing designation if any>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.
   i. Josam Company; Josam Div.
   j. Kusel Equipment Co.
   l. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: [Adjustable housing] [Cast-iron soil pipe with cast-iron ferrule] [Heavy-duty, adjustable housing] [Threaded, adjustable housing].
5. Body or Ferrule: Cast iron.
7. Outlet Connection: [Inside calk] [Spigot] [Threaded].
8. Closure: Brass plug with straight threads and gasket, Cast-iron plug.
9. Adjustable Housing Material: Cast iron with [threads] [set-screws or other device].
10. Frame and Cover Material and Finish: [Painted cast iron] [Polished bronze] [Rough bronze].
11. Frame and Cover Shape: [Round] [Square].
12. Top Loading Classification: [Extra Heavy] [Heavy] Duty.
13. Riser: ASTM A 74, [Extra-Heavy] [Service] class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts <Insert drawing designation if any>:

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

   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: [Hub-and-spigot, cast-iron soil pipe T-branch] [Hubless, cast-iron soil pipe test tee] as required to match connected piping.
5. Closure: [Countersunk] [Countersunk or raised-head] [Raised-head], [drilled-and-threaded] [brass] [cast-iron] plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: [Round] [Square], [nickel-bronze, copper-alloy, or stainless-steel] wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Commercial Enameling Co.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3[ with backwater valve].
3. Pattern: [Area] [Floor] [Funnel floor] [Sanitary] drain.
5. Seepage Flange: [Not required] [Required].
6. Anchor Flange: [Not required] [Required].
7. Clamping Device: [Not required] [Required].
8. Outlet: [Bottom] [Side].
9. Backwater Valve: [Drain-outlet type] [Integral, ASME A112.14.1, swing-check type] [Not required].
10. Coating on Interior and Exposed Exterior Surfaces: [Acid-resistant enamel] [Not required].
11. Sediment Bucket: [Not required].
12. Top or Strainer Material: [Bronze] [Gray iron] [Nickel bronze] [Stainless steel].
13. Top of Body and Strainer Finish: [Nickel bronze] [Polished bronze] [Rough bronze] [Stainless steel].
14. Top Shape: [Round] [Square].
15. Dimensions of Top or Strainer: <Insert dimensions and describe body, sump, and grate.>
16. Top Loading Classification: [Extra Heavy-Duty] [Heavy Duty] [Light Duty] [Medium Duty] <Delete if not applicable>.  
17. Funnel: [Not required] [Required].
18. Inlet Fitting: [Not required] [Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection].
19. Trap Material: [Bronze] [Cast iron] [Copper] [Not required].
20. Trap Pattern: [Deep-seal P-trap] [Standard P-trap] [Not required].
21. Trap Features: [Cleanout] [Trap-seal primer valve drain connection] [Cleanout and trap-seal primer valve drain connection] [Not required].

B. Stainless-Steel Floor Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Blucher-Josam Div.
   b. Josam Company; Josam Div.
   c. Kusel Equipment Co.
   d. Scherping Systems, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: [ASME A112.3.1] [ASME A112.6.3].
3. Outlet: [Bottom] [Side].
4. Top or Strainer Material: [Stainless steel].
5. Top Shape: [Round] [Square].
6. Dimensions of Top or Strainer: <Insert dimensions and describe body, sump, and grate.>
7. Seepage Flange: [Not required] [Required].
8. Anchor Flange: [Not required] [Required].
9. Clamping Device: [Not required] [Required].
10. Trap-Primer Connection: [Not required] [Required].
11. Trap Material: [Cast iron] [Stainless steel] [Not required].
12. Trap Pattern: [Deep-seal P-trap] [Standard P-trap] [Not required].

2.4 TRENCH DRAINS

A. Trench Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Material: Ductile or gray iron.
4. Flange: [Anchor] [Seepage] [Not required].
5. Clamping Device: [Not required] [Required].
6. Outlet: [Bottom] [End] [Side].
7. Grate Material: [Ductile iron] [Ductile iron or gray iron] [Gray iron] [Stainless steel].
8. Grate Finish: [Painted] [Not required].
9. Dimensions of Frame and Grate: <Insert dimensions and describe body, sump, and grate if required.>
10. Top Loading Classification: [Extra Heavy-Duty] [Heavy Duty] [Light Duty] [Medium Duty] <Delete if not applicable>.
11. Trap Material: [Cast iron] [Stainless steel] [Not required].
12. Trap Pattern: [Standard P-trap] [Not required].

2.5 CHANNEL DRAINAGE SYSTEMS

A. Stainless-Steel Channel Drainage Systems <Insert drawing designation if any>: 

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Blucher-Josam Div.

2. Type: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
   a. Standard: ASME A112.3.1, for trench drains.
   b. Channel Sections: Interlocking-joint, stainless-steel with level invert.
      1) Dimensions: [5.8 inches (147 mm)] [11.7 inches (297mm)] wide. Include number of units required to form total lengths indicated.
   c. Grates: Manufacturer's designation "[heavy] [medium] duty," with slots or perforations, and of width and thickness that fit recesses in channels.
      1) Material: [Ductile iron] [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].
      2) Locking Mechanism: [Manufacturer's standard device for securing grates to channel sections] [Not required].
   d. Covers: Solid [ductile or gray iron] [stainless steel], of width and thickness that fit recesses in channels, and of lengths indicated.
   e. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
   f. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

B. Polymer-Concrete Channel Drainage Systems <Insert drawing designation if any>: 

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABT, Inc.
   b. ACO Polymer Products, Inc.
   c. Forte Composites, Inc.
   d. Josam Company; Mea-Josam Div.
2. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

[Retain one of three "Channel Sections" subparagraphs and associated subparagraphs below.]

a. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

1) Dimensions: 4-inch (102-mm) inside width. Include number of units required to form total lengths indicated.
2) Frame: [Gray-iron or galvanized steel for grates] [Not required].

b. Grates: Manufacturer's designation "[heavy] [medium] duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: [Ductile iron] [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].
2) Locking Mechanism: [Manufacturer's standard device for securing grates to channel sections] [Not required].

c. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

[Retain subparagraph and associated subparagraphs below for narrow, level-invert, polymer-concrete channel drainage systems.]

f. Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 (DN 100) outlets in number and locations indicated.

1) Dimensions: 5-inch (127-mm) inside width and 9-3/4 inches (248 mm) deep. Include number of units required to form total lengths indicated.
2) Frame: [Gray-iron or galvanized steel for grates] [Not required].
g. Grates: Manufacturer's designation "[heavy] [medium] duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: [Ductile iron] [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].
2) Locking Mechanism: [Manufacturer's standard device for securing grates to channel sections] [Not required].

h. Covers: Solid [ductile or gray iron], of width and thickness that fit recesses in channel sections, and of lengths indicated.

i. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

j. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

[Retain subparagraph and associated subparagraphs below for wide, level-invert, polymer-concrete channel drainage systems.]

k. Channel Sections: Wide, interlocking-joint, precast, polymer-concrete modular units with end caps. Include flat or rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.

1) Dimensions: 8-inch (203-mm) inside width and 13-3/4 inches (350 mm) deep. Include number of units required to form total lengths indicated.
2) Frame: [Gray-iron or galvanized steel for grates] [Not required].

l. Grates: Manufacturer's designation "[heavy] [medium] duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: [Ductile iron] [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].
2) Locking Mechanism: [Manufacturer's standard device for securing grates to channel sections] [Not required].

m. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

n. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

o. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

C. Polymer-Concrete Sediment Interceptor <Insert drawing designation if any>:

1. Description: 27-inch- (686-mm-) square, precast, polymer-concrete body, with outlets in number and sizes indicated. Include 24-inch- (610-mm-) square, gray-iron slotted grate.
2. Frame: [Gray-iron or galvanized steel for grate] [Not required].

D. FRP Channel Drainage Systems <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ACO Polymer Products, Inc.
c. Josam Company; Mea-Josam Div.
e. Zurn Plumbing Products Group; Flo-Thru Operation.

2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. Channel Sections: Interlocking-joint, sloped-invert, FRP modular units, with end caps. Include flat, rounded, or inclined inside bottom, with outlets in number, sizes, and locations indicated.

1) Dimensions: [4 inches (102 mm)] [4 or 6 inches (102 or 152 mm)] [6 inches (152 mm)] [6 or 8 inches (152 or 203 mm)] [8 inches (203 mm)] wide. Include number of units required to form total lengths indicated.

2) Frame: [Galvanized steel] [Stainless steel] [Manufacturer's standard metal] <Insert material> for grates.

b. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.

1) Material: [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].

2) Locking Mechanism: [Manufacturer's standard device for securing grates to channel sections] [Not required].

c. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves <Insert drawing designation if any>:

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

   a. Oatey.
   b. RectorSeal.
   c. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves <Insert drawing designation if any>: 
1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. **Oatey**.
   b. **Studor, Inc**.

2. **Standard**: ASSE 1050 for vent stacks.
3. **Housing**: Plastic.
4. **Operation**: Mechanical sealing diaphragm.
5. **Size**: Same as connected stack vent or vent stack.

**C. Wall Box**

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. **Oatey**.
   b. **RectorSeal**.
   c. **Studor, Inc**.

2. **Description**: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
3. **Size**: About 9 inches wide by 8 inches high by 4 inches deep (230 mm wide by 200 mm high by 100 mm deep).

### 2.7 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; Elmdor/Stoneman Div**.
   b. **Thaler Metal Industries Ltd**.

**B. Description**: Manufactured assembly made of [4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-)] [6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-)] thick, lead flashing collar and skirt extending at least [6 inches (150 mm)] [8 inches (200 mm)] [10 inches (250 mm)] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

### 2.8 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

**A. Through-Penetration Firestop Assemblies:**
1. Refer to “Cleveland Clinic Firestopping and Fireproofing Performance Based Standard” for requirements.

2.9 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains <Insert drawing designation if any>:
   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 <Insert drawing designation if any>:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
      b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings <Insert drawing designation if any>:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

D. Air-Gap Fittings <Insert drawing designation if any>:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device <Insert drawing designation if any>:
   1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch (25 mm)] [2 inches (51 mm)] <Insert dimension> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings <Insert drawing designation if any>:
   1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps *<Insert drawing designation if any>*:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals *<Insert drawing designation if any>*:
   1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
   2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints *<Insert drawing designation if any>*:
   1. Standard: ASME A112.21.2M.
   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.

2.10 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
   3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
   2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.
H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.11 FOG DISPOSAL SYSTEMS

A. FOG Disposal Systems <Insert drawing designation if any>:

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

2. Standard: IAPMO PS 118, for removing solids from and breaking down and digesting suspended fats, oils, and greases from food[-preparation] or [-processing] wastewater.

3. Flow-Control Fitting: Matching unit size.

4. Strainer Unit: Stainless-steel housing with aluminum cover and removable-basket-type, stainless-steel, wire-mesh strainer. [Include pressure plug instead of cover.] [Include extra basket.] [Include stainless-steel extension.]

5. Media Chamber: Stainless-steel housing and aluminum cover, with internal baffles, piping, plastic coalescing surfaces, and clarifier section with test ports. [Include stainless-steel extension.]

6. Shelf: Stainless steel, 19.5 inches wide by 13 inches high by 8.75 inches deep (495 mm wide by 330 mm high by 222 mm deep), for metering pump, control devices, and culture bottle.

7. Culture Metering Pump, Timer, Control, and Tubing: Proprietary.

8. Culture: Include 1-gal. (3.8-L) bottle, as recommended by unit manufacturer.

9. Strainer and Media-Chamber, Unit Size: [20 gpm (1.26 L/s)] [35 gpm (2.21 L/s)].

10. Inlet and Outlet: NPS 2 (DN 50).

11. Strainer and Media-Chamber, Unit Size: [50 gpm (3.15 L/s)] [75 gpm (4.73 L/s)].

12. Inlet and Outlet: NPS 3 (DN 80).


15. Full-Load Amperes: <Insert value> A.

16. Minimum Circuit Ampacity: <Insert value> A.

17. Maximum Overcurrent Protection: <Insert value> A.

2.12 GREASE INTERCEPTORS

A. Grease Interceptors <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Applied Chemical Technology, Incorporated.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Rockford Sanitary Systems, Inc.
   e. Schier Products Company.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Specification Drainage Operation.
k. Ashland Trap Distribution Co.
l. Bio-Microbics, Inc.
m. Canplas LLC.
n. Schier Products Company.
o. Zurn Plumbing Products Group; Light Commercial Operation.

3. Plumbing and Drainage Institute Seal: [Not required] [Required].
4. Body Material: Cast iron or steel.
5. Interior Lining: Corrosion-resistant enamel.
8. Body Extension: [Not required] [Required].
9. Flow Rate: <Insert interceptor design rate.>
11. Inlet and Outlet Size: <Insert size.>
12. End Connections: [Flanged] [Hub] [Threaded].
13. Cleanout: Integral or field installed on outlet.
14. Mounting: [Above floor] [Recessed in acid-resistant, coated steel frame and cradle] [Recessed, flush with floor].
15. Flow-Control Fitting: [Not required] [Required].
16. Operation: [Automatic recovery] [Manual cleaning] [Semiautomatic, manual drawoff].

2.13 GREASE REMOVAL DEVICES

A. Grease Removal Devices <Insert drawing designation if any>: 

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

a. Josam Company; Blucher-Josam Div.

5. Heater: Not required.
6. Interior Lining: [Not required] <Insert description if required>.
7. Exterior Coating: [Not required] <Insert description if required>.
8. Unit Dimensions: <Insert dimensions.>
9. Flow Rate: <Insert recovery unit design rate.>
11. Inlet and Outlet Size: <Insert size.>
12. End Connections: [Flanged] [Hub] [Threaded].
13. Cleanout: Integral or field installed on outlet.
15. Flow-Control Fitting: Required.
17. Power Requirement: [120-V ac] <Insert power>.
18. Full-Load Amperes: <Insert value> A.
19. Minimum Circuit Ampacity: <Insert value> A.
20. Maximum Overcurrent Protection: <Insert value> A.
21. Waste Grease Receptacle: [Furnished by Cleveland Clinic] [Furnished by contractor].

2.14 SOLIDS INTERCEPTORS

A. Solids Interceptors <Insert drawing designation if any>:

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

   b. MIFAB, Inc.
   c. Rockford Sanitary Systems, Inc.
   d. Schier Products Company.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.
   i. 
   j. Ashland Trap Distribution Co.
   k. Schier Products Company.
   l. Town & Country Plastics, Inc.

2. Type: Factory-fabricated interceptor made for removing and retaining [lint] [sediment] from wastewater.
3. Body Material: [Cast iron or steel] [Stainless steel] [Plastic].
4. Interior Separation Device: [Baffles] [Screens].
5. Interior Lining: [Corrosion-resistant enamel] [Not required].
6. Exterior Coating: [Corrosion-resistant enamel] [Not required].
8. Flow Rate: [Not required] <Insert description if required>.
9. Inlet and Outlet Size: <Insert size.>
11. Mounting: [Above floor] [Inline].
2.15 MOTORS

A. General requirements for motors are 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting: Install [FOG disposal systems] [grease interceptors] [grease removal devices] [and] [solids interceptors] on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct bases to withstand, without damage to equipment, seismic force required by code.
3. Construct concrete bases [4 inches (100 mm)] [6 inches (150 mm)] [8 inches (200 mm)] high and extend base not less than 6 inches (150 mm) in all directions beyond the maximum dimensions of [FOG disposal systems] [grease interceptors] [grease removal devices] [and] [solids interceptors], unless otherwise indicated or unless required for seismic anchor support.
4. Minimum Compressive Strength: [5000 psi (34.5 MPa)] [4500 psi (31 MPa)] [4000 psi (27.6 MPa)] [3500 psi (24.1 MPa)] [3000 psi (20.7 MPa)] at 28 days.
5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
6. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
7. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
8. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.
D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
   b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
   c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

I. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

[K. Assemble open drain fittings and install with top of hub [1 inch (25 mm)] [2 inches (51 mm)] above floor.

L. Install deep-seal traps on floor drains and other waste outlets, if indicated.

M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.]
2. Size: Same as floor drain inlet.

P. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

Q. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

R. Install vent caps on each vent pipe passing through roof.

S. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

T. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

U. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

V. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.

W. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

X. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.

Y. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing. Coordinate oil-interceptor storage tank and gravity drain with Section 231113 "Facility Fuel-Oil Piping."

Z. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

AA. Install wood-blocking reinforcement for wall-mounting-type specialties.
BB. 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. FOG Disposal Systems: Connect inlet and outlet to unit, connect flow-control fitting and fresh-air inlet piping to unit inlet piping, and connect vent piping between trap and media chamber. Connect electrical power.

D. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

E. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

F. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

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

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. FOG disposal systems.
2. Grease interceptors.
4. Oil interceptors.
5. Solids interceptors.

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."

3.5 FIELD QUALITY CONTROL

[Delete this Article if no FOG disposal systems or grease removal devices.]

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled [FOG disposal systems] [and] [grease removal devices] and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain [FOG disposal systems] [and] [grease removal devices]. Refer to Section 017900 "Demonstration and Training." 01820

END OF SECTION 221319
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. Grease interceptors.
   2. Oil interceptors.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of [metal] [concrete double wall] [and] [plastic] interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
   1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

   1. Interceptors.
   2. Piping connections. Include size, location, and elevation of each.
   3. Interface with underground structures and utility services.
1.6 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Cleveland Clinic or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify Construction Manager and Cleveland Clinic Plumbing Supervisor no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without Cleveland Clinic Plumbing Supervisor’s written permission.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C 913.

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
2. Structural Design Loads:
   d. Walkway Load: Comply with ASTM C 890, A-03.
3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
4. Steps: Individual FRP steps or FRP ladder | Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP | ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
   a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
   c. Include indented top design with lettering cast into cover, using wording equivalent to "[INTERCEPTOR] [GREASE INTERCEPTOR] [SANITARY SEWER]."

B. Capacities and Characteristics:
1. Length by Width by Depth: <Insert inches (mm)>.
2. Number of Compartments: [One] [Two].
3. Retention Capacity: <Insert gal. or lb (L or kg)>.
4. Inlet and Outlet Pipe Size: <Insert NPS (DN)>.
   a. Centerline of Inlet to Floor: <Insert inches (mm)>
   b. Centerline of Outlet to Floor: <Insert inches (mm)>

5. Trapped Outlet Required: [Integral] [No] [Yes].
6. Vent Pipe Size: [Not required] <Insert NPS (DN)>
7. Installation Position: [Top flush with grade] [Underground with manhole riser to grade].

2.2 OIL INTERCEPTORS

A. Oil Interceptors: Precast concrete comply with ASTM C 913.
   1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
   2. Structural Design Loads:
      d. Walkway Load: Comply with ASTM C 890, A-03.

   3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
   4. Steps: [Individual FRP steps or FRP ladder] [Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP] [ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP], wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).

   5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
   6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
      a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
      c. Include indented top design with lettering cast into cover, using wording equivalent to "[INTERCEPTOR] [OIL INTERCEPTOR] [SANITARY SEWER]."

   7. Waste-oil storage tank and piping are specified in Section 231113 "Facility Fuel-Oil Piping."
B. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Parkson Corporation.
   d. Rockford Sanitary Systems, Inc.
   e. Schier Products Company.
   g. Tyler Pipe, Inc.
   h. Watts Water Technologies, Inc.
   i. Zurn Plumbing Products Group; Zurn Specification Drainage Products.

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-03, walkway load.
5. Comply with requirements in Section 231113 "Facility Fuel-Oil Piping" for waste-oil storage tank and piping.

C. Oil Interceptors: Plastic body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Green Turtle (USA).
   b. Parkson Corporation.
   c. Schier Products Company.
   d. Town & Country Plastics, Inc.

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
5. Waste-oil storage tank and piping are specified in Section 231113 "Facility Fuel-Oil Piping."

D. Capacities and Characteristics:

1. Capacity: [Not applicable] <Insert gal. (L)>.
2. Overall Dimensions: <Insert inches (mm)>.
3. Inlet and Outlet Pipe Size: <Insert NPS (DN)>.

   a. Centerline of Inlet to Floor: <Insert inches (mm)>.
b. Centerline of Outlet to Floor: \(<\text{Insert inches (mm)}>)\.

4. Waste-Oil-Outlet Pipe Size: \(<\text{Insert NPS (DN)}>)\.
   
   a. Centerline of Outlet to Floor: \(<\text{Insert inches (mm)}>)\.

5. Trapped Outlet Required: [Integral] [No] [Yes].
6. Vent Pipe Size: \(<\text{Insert NPS (DN)}>)\.
7. Installation Position: [Top flush with grade] [Underground with extension to grade] [Underground with manhole riser to grade].

2.3 SAND INTERCEPTORS

A. Description: Factory-fabricated, load bearing, cast-iron or steel body and inlet grate; with settlement chamber and removable basket or strainer.

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

1. MIFAB, Inc.
2. Rockford Sanitary Systems, Inc.
4. Tyler Pipe, Inc.

C. Outlet Piping Connection: Hub, hubless, or threaded, unless otherwise indicated.

D. Grate: Cast iron or steel with reinforcement to provide ASTM C 890, A-03, walkway load.

E. Capacities and Characteristics:

1. Capacity: [Not applicable] \(<\text{Insert gal. (L)}>)\.
2. Overall Dimensions: \(<\text{Insert inches (mm)}>)\.
3. Outlet Pipe Size: \(<\text{Insert NPS (DN)}>)\.
4. Trapped Outlet Required: [Integral] [No] [Yes].
5. Vent Pipe Size: [Not required] \(<\text{Insert NPS (DN)}>)\.
6. Installation Position: [Top flush with grade].

2.4 PRECAST-CONCRETE MANHOLE RISERS

A. Precast-Concrete Manhole Risers: [ASTM C 478 (ASTM C 478M)] [ASTM C 913], with rubber-gasket joints.

1. Structural Design Loads:
   
   d. Walkway Load: Comply with ASTM C 890, A-03.
2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch (75-mm) minimum thickness and 36-inch (915-mm) diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
6. Steps: [Individual FRP steps or FRP ladder] [Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP] [ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP], wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
3. Include indented top design with lettering cast into cover, using wording equivalent to the following:

   a. Grease Interceptors in Sanitary Sewerage System: "[INTERCEPTOR] [GREASE INTERCEPTOR] [SANITARY SEWER]."
   b. Oil Interceptors in Sanitary Sewerage System: "[INTERCEPTOR] [OIL INTERCEPTOR] [SANITARY SEWER]."

PART 3 - EXECUTION

3.1 EARTHWORK

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

3.2 INSTALLATION

   A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.
   B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
   C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches (75 mm) above finish surface elsewhere, unless otherwise indicated.
   D. Set tops of grating frames and grates flush with finished surface.
   E. Set [metal] [and] [plastic] interceptors level and plumb.
F. Set tops of metal interceptor covers flush with finished surface in pavements. Set tops 3 inches (75 mm) above finish surface elsewhere, unless otherwise indicated.

G. Install piping and oil storage tanks according to Section 231113 "Facility Fuel-Oil Piping."

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 221323
SECTION 221329 - SANITARY SEWERAGE 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. Submersible effluent pumps.
2. Submersible sewage pumps.
3. Wet-pit-volute sewage pumps.
4. Sewage-pump, reverse-flow assemblies.
5. Sewage-pump basins and basin covers.
6. Progressing-cavity sewage pumps.
7. Packaged, submersible sewage-pump units.
8. Packaged wastewater-pump units.

B. Related Sections include the following:

1. Section 221343 "Facility Packaged Sewage Pumping Stations" for applications in site-construction sewage pumping.
2. Section 221429 "Sump Pumps" for applications in storm-drainage systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. [Include construction details, material descriptions, dimensions of individual components and profiles.] [Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.]

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.
1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

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 rigging instructions for handling.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 SUBMERSIBLE EFFLUENT PUMPS

A. Submersible, Fixed-Position, Single-Seal Effluent Pumps:

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

   a. Bell & Gossett Domestic Pump; ITT Corporation.
   b. Grundfos Pumps Corp.
   c. Liberty Pumps.
   d. Pentair Pump Group; Hydromatic Pumps.
   e. Zoeller Company.

2. Description: Factory-assembled and -tested effluent-pump unit.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], closed or semiopen design for clear wastewater, and keyed and secured to shaft.

6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.

7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   
a. Motor Housing Fluid: [Air] [Oil].

9. Controls:
   
a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:
    
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      
      1) On-off status of pump.
      2) Alarm status.

B. Submersible, Fixed-Position, Double-Seal Effluent Pumps:

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

2. Description: Factory-assembled and -tested effluent-pump unit.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], closed or semi-open design for clear wastewater, and keyed and secured to shaft.

6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.

7. Seals: Mechanical.

8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.

9. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
a. Motor Housing Fluid: [Air] [Oil].

10. Controls:
   a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

C. Submersible, Quick-Disconnect, Single-Seal Effluent Pumps:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Zoeller Company.
   2. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
   5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], closed or semi-open design for clear wastewater, and keyed and secured to shaft.
   7. Seal: Mechanical.
   8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
      a. Motor Housing Fluid: [Air] [Oil].
   9. Controls:
      a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

11. Guide-Rail Supports:
   b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
   c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
   d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
   e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
   f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
   g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

D. Submersible, Quick-Disconnect, Double-Seal Effluent Pumps:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Zoeller Company.
   2. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
   5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], closed or semi-open design for clear wastewater, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.
7. Seals: Mechanical.
8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
9. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   a. Motor Housing Fluid: [Air] [Oil].
10. Controls:
    a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
    b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
11. Control-Interface Features:
    b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
       1) On-off status of pump.
       2) Alarm status.
12. Guide-Rail Supports:
    b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
    c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
    d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
    e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
    f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
    g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.
E. Capacities and Characteristics:
1. Unit Capacity: <Insert gpm (L/minute)>.
2. Number of Pumps: [One] [Two].
3. Each Pump:
a. Capacity: <Insert gpm (L/minute)>.

b. Solids Handling Capability: [Not applicable] [2 inches (50 mm)] [2-1/2 inches (65 mm)] [3 inches (75 mm)] minimum.

c. Total Dynamic Head: <Insert feet (kPa)>.

d. Speed: <Insert rpm>.

e. Discharge Pipe Size: <Insert NPS (DN)>.

f. Motor Horsepower: <Insert value>.

g. Electrical Characteristics:

   1) Volts: [120] [240] [277] [480].
   2) Phases: [Single] [Three].
   3) Hertz: 60.

4. Unit Electrical Characteristics:

   a. Full-Load Amperes: <Insert value>.
   b. Minimum Circuit Ampacity: <Insert value>.
   c. Maximum Overcurrent Protection: <Insert value> A.

2.2 SUBMERSIBLE SEWAGE PUMPS

A. Submersible, Fixed-Position, Single-Seal Sewage Pumps:

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

      a. Bell & Gossett Domestic Pump; ITT Corporation.
      b. Pentair Pump Group; Hydromatic Pumps.
      c. Weil Pump Company, Inc.

   2. Description: Factory-assembled and -tested sewage-pump unit.

   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.

   4. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

   5. Impeller: Statically and dynamically balanced. [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.

   6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.

   7. Seal: Mechanical.

   8. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

      a. Motor Housing Fluid: [Air] [Oil].

   9. Controls:
a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
b. Switch Type:  [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

B. Submersible, Fixed-Position, Double-Seal Sewage Pumps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bell & Gossett Domestic Pump; ITT Corporation.
   b. Pentair Pump Group; Hydromatic Pumps.
   c. Weil Pump Company, Inc.

2. Description: Factory-assembled and -tested sewage-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.
7. Seals: Mechanical.
8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
9. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   a. Motor Housing Fluid: [Air] [Oil].

10. Controls:
   a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type:  [Mechanical-float] [Mercury-float] [Pressure] <Insert type> type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:

b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

   1) On-off status of pump.
   2) Alarm status.

C. Submersible, Quick-Disconnect, Single-Seal Sewage Pumps:

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

   a. **EBARA Fluid Handling**.
   b. **Gorman-Rupp Company (The)**.
   c. **Goulds Pumps; ITT Corporation; ITT Flygt Corporation**.
   d. **PACO Pumps; Grundfos Pumps Corporation, U.S.A**.
   e. **Pentair Pump Group; Hydromatic Pumps**.
   f. **Pentair Pump Group; Myers**.
   g. **Swaby Manufacturing Company**.
   h. **Weil Pump Company, Inc**.
   i. **WILO-EMU USA LLC**.
   j. **Zoeller Company**.

2. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.

5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast bronze] [and] [stainless steel], non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.

6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.

7. Seal: Mechanical.

8. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: [Air] [Oil].

9. Controls:
a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

11. Guide-Rail Supports:
   b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
   c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
   d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
   e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
   f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
   g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

D. Submersible, Quick-Disconnect, Double-Seal Sewage Pumps:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Barnes; Crane Pumps & Systems.
      b. Bell & Gossett Domestic Pump; ITT Corporation.
      c. Pentair Pump Group; Hydromatic Pumps.
      d. Weil Pump Company, Inc.

   2. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.
   3. Pump type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
   5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [ASTM B 584, cast iron].
bronze] and [stainless steel], nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.

6. Pump and Motor Shaft: Stainless steel [or steel], with factory-sealed, grease-lubricated ball bearings.

7. Seals: Mechanical.

8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.

9. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: [Air] [Oil].

10. Controls:

    a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
    
b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    
c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:

    
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

       1) On-off status of pump.
       2) Alarm status.

12. Guide-Rail Supports:

    
b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
    
c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
    
d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
    
e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
    
f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
    
g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

E. Submersible, Quick-Disconnect, Grinder Sewage Pumps:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Barnes; Crane Pumps & Systems.
b. Pentair Pump Group; Hydromatic Pumps.
c. Weil Pump Company, Inc.
d. Zoeller Company.

2. Description: Factory-assembled and -tested, grinder sewage-pump unit with guide-rail supports.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail supports.

5. Impeller: Bronze or stainless steel; statically and dynamically balanced, with stainless-steel cutter, grinder, or slicer assembly; capable of handling solids; and keyed and secured to shaft.


7. Seal: Mechanical.

8. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: [Air] [Oil]

9. Controls:

   a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

    b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

        1) On-off status of pump.
        2) Alarm status.

11. Guide-Rail Supports:

    b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
    c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

F. Submersible, Quick-Disconnect, Progressing-Cavity, Grinder Sewage Pumps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Barnes; Crane Pumps & Systems.
   b. Environment One Corporation.
   c. Pentair Pump Group; Hydromatic Pumps.

2. Description: Factory-assembled and -tested progressing-cavity, grinder sewage-pump unit with guide-rail supports.
3. Pump Type: Submersible, progressing-cavity, single-screw rotary, grinder sewage pump as defined in HI 3.1-3.5.
4. Pump Body: Cast iron.
5. Pump Bearings: Radial and thrust types.
8. Stator: [Buna-N] [or] [natural rubber].
10. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

11. Controls:
   a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

12. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.
13. Guide-Rail Supports:
   b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
   c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
   d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
   e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
   f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
   g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

G. Capacities and Characteristics:
   1. Unit Capacity: <Insert gpm (L/minute)>.
   2. Number of Pumps: [One] [Two].
   3. Each Pump:
      a. Capacity: <Insert gpm (L/minute)>.
      b. Solids Handling Capability: [Not applicable] [2 inches (50 mm)] [2-1/2 inches (65 mm)] [3 inches (75 mm)] <Insert inches (mm)> minimum.
      c. Total Dynamic Head: <Insert feet (kPa)>.
      d. Speed: <Insert rpm>.
      e. Discharge Pipe Size: <Insert NPS (DN)>.
      f. Motor Horsepower: <Insert value>.
      g. Electrical Characteristics:
         1) Volts: [120] [240] [277] [480].
         2) Phases: [Single] [Three].
         3) Hertz: 60.
   4. Unit Electrical Characteristics:
      a. Full-Load Amperes: <Insert value>.
      b. Minimum Circuit Ampacity: <Insert value>.
      c. Maximum Overcurrent Protection: <Insert value> A.

2.3 WET-PIT-VOLUTE SEWAGE PUMPS

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

1. Alyan Pump Company.
2. Armstrong Pumps Inc.
3. Chicago Pump Company; a division of Yeomans Chicago Corporation.
4. Federal Pump Corp.
5. Flo Fab inc.
6. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
7. Peerless Pump, Inc.
8. Pentair Pump Group; Aurora Pump.
10. Tramco Pump Company.
13. Weinman Division; Crane Pumps & Systems.

B. Description: Factory-assembled and -tested sewage-pump unit.

C. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.

D. Pump Casing: Cast iron, with open inlet and threaded or flanged connection for discharge piping.

E. Pump Shaft: [Stainless-steel] [and] [steel].

F. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], non-clog, open, or semi-open design for solids handling, and keyed and secured to shaft.

G. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.

H. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

I. Pump Discharge Piping: Factory or field fabricated, [galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings] <Insert pipe material>.

    1. Modify piping configuration to accommodate reverse-flow assembly.

J. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sewage-Pump Basins and Basin Covers" Article for requirements.

K. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

L. Motor: Single-speed; grease-lubricated ball bearings and mounted on vertical, cast-iron pedestal.

M. Controls:

    1. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
2. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
4. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

N. Control-Interface Features:
1. Remote Alarm Contacts: For remote alarm interface.
2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
   a. On-off status of pump.
   b. Alarm status.

O. Capacities and Characteristics:
1. Unit Capacity: <Insert gpm (L/minute)>.
2. Number of Pumps: [One] [Two].
3. Each Pump:
   a. Capacity: <Insert gpm (L/minute)>.
   b. Solids Handling Capability: [2 inches (50 mm)] [2-1/2 inches (65 mm)] [3 inches (75 mm)] minimum.
   c. Total Dynamic Head: <Insert feet (kPa)>.
   d. Speed: <Insert rpm>.
   e. Discharge Pipe Size: <Insert NPS (DN)>.
   f. Motor Horsepower: <Insert value>.
   g. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480].
      2) Phases: [Single] [Three].
      3) Hertz: 60.

4. Unit Electrical Characteristics:
   a. Full-Load Amperes: <Insert value>.
   b. Minimum Circuit Ampacity: <Insert value>.
   c. Maximum Overcurrent Protection: <Insert value> A.

2.4 SEWAGE-PUMP, REVERSE-FLOW ASSEMBLIES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chicago Pump Company; a division of Yeomans Chicago Corporation.
2. Federal Pump Corp.
3. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
4. Peerless Pump, Inc.
5. Weil Pump Company, Inc.

B. Description: Factory-fabricated, sewage pump reverse-flow assembly for factory or field assembly and installation in sewage pump basin. Include the following corrosion-resistant-metal components:

1. Inlet Fitting: One combination inlet-overflow strainer fitting.
2. Valves: Two shutoff valves and two check valves.
4. Pipe and Fittings: Size and configuration required to connect to sewage pumps and piping.

2.5 SEWAGE-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.

1. Material: [Cast iron] [Fiberglass] [Polyethylene].
2. Reinforcement: Mounting plates for pumps, fittings [, guide-rail supports if used,] and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

C. Capacities and Characteristics:

1. Capacity: <Insert gal (L)>.
2. Diameter: <Insert inches (mm)>.
3. Depth: <Insert inches (mm)>.
4. Inlet No. 1:
   a. Drainage Pipe Size: <Insert NPS (DN)>.
   b. Bottom of Sump to Centerline: <Insert inches (mm)>.
   c. Type: [Flanged] [Hubbed] [Threaded] outside.

5. Inlet No. 2:
   a. Drainage Pipe Size: <Insert NPS (DN)>.
   b. Bottom of Sump to Centerline: <Insert inches (mm)>.
   c. Type: [Flanged] [Hubbed] [Threaded] outside.

6. Inlet No. 3:
a. Drainage Pipe Size: <Insert NPS (DN)>
   b. Bottom of Sump to Centerline: <Insert inches (mm)>
   c. Type: [Flanged] [Hubbed] [Threaded] outside.

7. Sidewall Outlet:
   a. Discharge Pipe Size: <Insert NPS (DN)>
   b. Bottom of Sump to Centerline: <Insert inches (mm)>
   c. Type: [Hubbed inside] [Hubbed outside]

8. Cover Material: [Cast iron] [Steel with bituminous coating] [Cast iron or steel with bituminous coating]
9. Cover Diameter: <Insert inches (mm)>, but not less than outside diameter of basin top flange.
10. Manhole Required in Cover: [Yes] [No]
11. Vent Size: <Insert NPS (DN)>

2.6 PROGRESSING-CAVITY SEWAGE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Continental Pump Co.

B. Description: Factory-assembled and -tested progressing-cavity, single-screw rotary pump as defined in HI 3.1-3.5.

C. Pump Body: Cast iron with feet for base or floor installation.

D. Pump Bearings: Radial and thrust types.

E. Pump Shaft: Steel.

F. Rotor: Chrome-plated steel.

G. Stator: [Buna-N] [or] [natural rubber].

H. Seals: Packing gland and mechanical types.

I. Coupling: Flexible.


K. Capacities and Characteristics:
   1. Capacity: <Insert gpm (L/minute)>.  
   2. Solids Handling Capability: [Not applicable] [2 inches (50 mm)] [2-1/2 inches (65 mm)] [3 inches (75 mm)] <Insert inches (mm)> minimum.
   3. Total Dynamic Head: <Insert feet (kPa)>.
4. Speed: \(<\text{Insert rpm}>\).
5. Discharge Pipe Size: \(<\text{Insert NPS (DN)}>\).
6. Motor Horsepower: \(<\text{Insert value}>\).
7. Electrical Characteristics:
   a. Volts: \([120] [240] [277] [480]\).
   b. Phases: [Single] [Three].
   c. Hertz: 60.
8. Unit Electrical Characteristics:
   a. Full-Load Amperes: \(<\text{Insert value}>\).
   b. Minimum Circuit Ampacity: \(<\text{Insert value}>\).
   c. Maximum Overcurrent Protection: \(<\text{Insert value}>\) A.

2.7 PACKAGED, SUBMERSIBLE SEWAGE-PUMP UNITS

A. Packaged, Submersible, Grinder, Sewage-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Barnes; Crane Pumps & Systems.
      b. Environment One Corporation.
      c. Pentair Pump Group; Myers.
      d. Zoeller Company.
   2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, grinder, sewage-pump unit.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Cast iron.
   5. Impeller: Stainless-steel grinder [cutter, or slicer] type with shredding ring.
   6. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   7. Controls: Automatic, with mechanical- or mercury-float switches and alternator.
   8. Pump Discharge Piping: Factory or field fabricated, [galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings].
   9. Basin: Watertight [plastic] and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.

B. Packaged, Submersible, Non-clog, Sewage-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Barnes; Crane Pumps & Systems.
      b. Bell & Gossett Domestic Pump; ITT Corporation.
      c. Glentronics, Inc.
d. Goulds Pumps; ITT Corporation.
e. Grundfos Pumps Corp.
f. Liberty Pumps.
g. Little Giant Pump Co.
h. McDonald, A. Y. Mfg. Co.
i. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
j. Pentair Pump Group; Hydromatic Pumps.
k. Pentair Pump Group; Myers.
l. Sta-Rite Industries, Inc.
m. Zoeller Company.

2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sewage-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron.
5. Impeller: Brass or cast iron; statically and dynamically balanced, non-clog design, and capable of handling 2-inch (50-mm) diameter solids.
6. Motor: Hermetically sealed capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
7. Controls: Automatic, with mechanical- or mercury-float switches and alternator.
8. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings.
9. Basin: Watertight plastic and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.

C. Capacities and Characteristics:

1. System Capacity: <Insert gpm (L/minute)>
2. Number of Pumps: [One] [Two]
3. Each Pump:
   a. Capacity: <Insert gpm (L/minute)>
   b. Total Dynamic Head: <Insert feet (kPa)>
   c. Speed: <Insert rpm>
   d. Discharge Pipe Size: <Insert NPS (DN)>
   e. Motor Horsepower: <Insert value>
   f. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480]
      2) Phases: [Single] [Three]
      3) Hertz: 60
4. Unit Electrical Characteristics:
   a. Full-Load Amperes: <Insert value>
   b. Minimum Circuit Ampacity: <Insert value>
   c. Maximum Overcurrent Protection: <Insert value> A
5. Alternator Control Required: [Yes] [No].
6. Basin:
   a. Dimensions: <Insert values>.
   b. Inlet Size: <Insert NPS (DN)>
   c. Bottom to Inlet Centerline: <Insert inches (mm)>
   d. Vent Size: <Insert NPS (DN)>

2.8 PACKAGED WASTEWATER-PUMP UNITS

A. Packaged, Wet-Pit-Volute, Wastewater-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alyan Pump Company.
      b. Federal Pump Corp.
      c. Hartell Pumps; a div. of Milton Roy Company.

   2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, effluent-pump unit.
   3. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
   5. Motor: With built-in overload protection and mounted vertically on basin cover.
   6. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
   8. Pump Discharge Piping: Factory or field fabricated. [galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings].
   9. Basin: Watertight, aluminum, plastic or coated steel with inlet pipe connection and gastight cover with vent and pump discharge connections.

B. Packaged, Submersible Wastewater-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABS Pumps Inc.
      b. Bell & Gossett Domestic Pump; ITT Corporation.
      c. Goulds Pumps; ITT Corporation.
      d. Grundfos Pumps Corp.
      e. Liberty Pumps.
      f. Little Giant Pump Co.
      g. McDonald, A. Y. Mfg. Co.
      h. Pentair Pump Group; Myers.
      i. Sta-Rite Industries, Inc.
      j. Zoeller Company.
2. Description: Factory-assembled and -tested, automatic-operation, effluent-pump unit with basin.
3. Pump Type: Submersible, end-suction, single-stage, overhung-impeller, centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
5. Pump Seals: Mechanical.
7. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
9. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings.
10. Basin: Watertight plastic with inlet pipe connection and gastight cover with vent and pump discharge connections.
11. Capacities and Characteristics:
   a. Pump Capacity: <Insert gpm (L/minute)>.
   b. Total Dynamic Head: <Insert feet (kPa)>.
   c. Speed: <Insert rpm>.
   d. Discharge Pipe Size: <Insert NPS (DN)>.
   e. Motor Horsepower: <Insert value>.
   f. Electrical Characteristics:
      1) Volts: [120][240].
      2) Phases: [Single][Three].
      3) Hertz: 60.
   g. Unit Electrical Characteristics:
      1) Full-Load Amperes: <Insert value>.
      2) Minimum Circuit Ampacity: <Insert value>.
      3) Maximum Overcurrent Protection: <Insert value> A.
   h. Basin:
      1) Capacity: [2 gal (7.6 L)] [4 gal (15.1 L)] minimum.
      2) Inlet Connection: NPS 1-1/2 (DN 40) minimum.
      3) Vent Connection: NPS 1-1/2 (DN 40) minimum.

2.9 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.

B. Motors for submersible pumps shall be hermetically sealed.
PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

3.3 INSTALLATION

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.
2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Equipment Mounting: Install progressing-cavity sewage pumps on concrete base using [elastomeric pads] [elastomeric mounts] [restrained spring isolators]. Comply with requirements for concrete base specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

1. Minimum Deflection: [1/4 inch (6 mm)] [1 inch (25 mm)].
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Install progressing-cavity sewage pumps using [elastomeric pads] [elastomeric mounts] [restrained spring isolators]. Comply with requirements for vibration isolation devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. Minimum Deflection: [1/4 inch (6 mm)] [1 inch (25 mm)].

D. Equipment Mounting: Install progressing-cavity sewage pumps on vibration isolation equipment base. Comply with requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain controls and 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. Pipe, tube, and fittings.
   2. Specialty pipe fittings.
   3. Encasement for underground metal piping.

B. Related Sections:
   1. Section 221429 "Sump Pumps" for storm drainage pumps.
   2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 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 (30 kPa).
   2. Storm Drainage, Force-Main Piping: [50 psig (345 kPa)] [100 psig (690 kPa)] [150 psig (1035 kPa)].

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Shop Drawings: For [controlled-flow] [siphonic] roof drainage system. Include calculations, plans, and details.
1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

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


1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Cleveland Clinic or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager and Cleveland Clinic Plumbing Supervisor no fewer than seven days in advance of proposed interruption of storm-drainage service.
   2. Do not proceed with interruption of storm-drainage service without Cleveland Clinic Plumbing Supervisor’s written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Products shall be American made.

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

A. Pipe and Fittings: ASTM A 74, [Service] [and] [Extra Heavy] classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Clamp-All Corp.
      b. Ideal.
      c. Mission
   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 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight. Include square-cut-grooved or threaded ends matching joining method.


C. Steel-Pipe Pressure Fittings:

D. Cast-Iron Flanges: ASME B16.1, Class 125.
   1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
   2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International.
      b. Grinnell Mechanical Products.
      c. Shurjoint Piping Products.
      d. Victaulic Company.

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. 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.


3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. 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.


C. Ductile-Iron, Grooved-Joint Piping:


2. Ductile-Iron-Pipe Appurtenances:

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

      1) Anvil International.
      2) Shurjoint Piping Products.
      3) Star Pipe Products.
      4) Victaulic Company.


   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. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

E. Copper Pressure Fittings:
   2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
   2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in OD's 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         2) Fernco Inc.
         3) Mission Rubber Company; a division of MCP Industries, Inc.
         4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      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. Sleeve Materials:
2) For Dissimilar Pipes: ASTM D 5926, material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2) Mission Rubber Company; a division of MCP Industries, Inc.
   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.

5. Pressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2) Dresser, Inc.
      3) EBAA Iron, Inc.
      4) Ford Meter Box Company, Inc. (The)
      5) JCM Industries, Inc.
      6) Romac Industries, Inc.
      7) Smith-Blair, Inc.; a Sensus company.
      8) Viking Johnson; c/o Mueller Co.
   c. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
   d. Center-Sleeve Material: [Manufacturer's standard] [Carbon steel] [Stainless steel] [Ductile iron] [Malleable 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Capitol Manufacturing Company.
      2) Central Plastics Company.
3) Hart Industries International, Inc.
4) Jomar International Ltd.
5) Matco-Norca, Inc.
7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
8) Wilkins; a Zurn company.

b. Description:
   1) Standard: ASSE 1079.
   2) Pressure Rating: [150 psig (1035 kPa)] [250 psig (1725 kPa)] at 180 deg F (82 deg C).
   3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Capitol Manufacturing Company.
      2) Central Plastics Company.
      3) Matco-Norca, Inc.
      4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      5) Wilkins; a Zurn company.
   
   b. Description:
      1) Standard: ASSE 1079.
      2) Factory-fabricated, bolted, companion-flange assembly.
      3) Pressure Rating: [150 psig (1035 kPa)] [175 psig (1200 kPa) minimum] [300 psig (2070 kPa)].
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Advance Products & Systems, Inc.
      2) Calpico, Inc.
      3) Central Plastics Company.
      4) Pipeline Seal and Insulator, Inc.
   
   b. Description:
      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 150 psig (1035 kPa).
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
5. Dielectric Nipples:
   a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      1) Elster Perfection.
      2) Grinnell Mechanical Products.
      3) Matco-Norca, Inc.
      4) Precision Plumbing Products, Inc.
      5) Victaulic Company.
   b. **Description:**
      1) Electroplated steel nipple complying with ASTM F 1545.
      2) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
      3) End Connections: Male threaded or grooved.
      4) Lining: Inert and noncorrosive, propylene.

2.8 ENCASEMENT FOR UNDERGROUND METAL PIPING

   A. **Standard:** ASTM A 674 or AWWA C105.
   B. **Material:** [High-density, crosslaminated PE film of 0.004-inch (0.10-mm)] [or] [LLDPE film of 0.008-inch (0.20-mm)] minimum thickness.
   C. **Form:** [Sheet] [or] [tube].
   D. **Color:** [Black] [or] [natural].

PART 3 - EXECUTION

3.1 EARTH MOVING

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

3.2 PIPING INSTALLATION

   A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations 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 storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: [1 percent] [2 percent] downward in direction of flow for piping NPS 3 (DN 80) and smaller; [1 percent] [2 percent] downward in direction of flow for piping NPS 4 (DN 100) 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."

[Retain subparagraph below if piping will be in corrosive soil.]

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

O. Install steel piping according to applicable plumbing code.

P. Install engineered [controlled-flow] [siphonic] drain specialties and storm drainage piping in locations indicated.
Q. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

[Retain subparagraph below if piping will be in corrosive soil.]

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

R. Install force mains at elevations indicated.

S. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. 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. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. 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."

V. 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."

W. 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


D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

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.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: [Unshielded] [Shielded], nonpressure transition couplings.
4. In Underground Force-Main Piping:
   a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
   b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [nipples] [unions].
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [flanges] [flange kits] [nipples].
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Install gate valve for piping NPS 2-1/2 (DN 65) 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 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."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install [stainless-steel] [fiberglass] 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. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52, spring hangers.
C. Support horizontal piping and tubing within 12 inches (300 mm) 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 (10-mm) 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 and NPS 8 (DN 150 and DN 200): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 10 and NPS 12 (DN 250 and DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

K. Install supports for vertical copper tubing every 10 feet (3 m).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

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] [in pit with pit cover flush with floor].
3. Comply with requirements for [backwater valves] [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 of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. 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. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping[ except outside leaders] on completion of roughing-in. Close openings in piping system and fill with water to point of overflow,
but not less than 10-foot head of water (30 kPa). 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.

E. 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. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. 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.

3.10 CLEANING
A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE
A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
   4. Copper DWV tube, copper drainage fittings, and soldered joints.
   5. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.
C. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
4. Copper DWV tube, copper drainage fittings, and soldered joints.
5. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

D. Underground storm drainage piping **NPS 6 (DN 150)** and smaller shall be any of the following:

1. [Extra Heavy] [Service] class, cast-iron soil pipe and fittings; [gaskets; and gasketed] [calking materials; and caked] joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

E. Underground, storm drainage piping **NPS 8 (DN 200)** and larger shall be any of the following:

1. [Extra Heavy] [Service] class, cast-iron soil pipe and fittings; [gaskets; and gasketed] [calking materials; and caked] joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: [Unshielded] [Shielded], nonpressure transition couplings.

F. Aboveground storm drainage force mains **NPS 1-1/2 and NPS 2 (DN 40 and DN 50)** shall be any of the following:

1. Hard copper tube, 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 (DN 65 to DN 150)** shall be any of the following:

1. Hard copper tube, 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 (DN 100)** and smaller shall be any of the following:

1. [Hard] [Soft] copper tube; [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 (DN 40)** and pressure transition coupling for **NPS 1-1/2 (DN 40)** and larger if dissimilar pipe materials.

I. Underground storm drainage force mains **NPS 5 (DN 125)** and larger shall be any of the following:

1. Hard copper tube; [wrought-]copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221413
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. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.
5. Trench drains.
6. Channel drainage systems.
7. Through-penetration firestop assemblies.
8. Flashing materials.

B. Products shall be American made.

1.3 ACTION SUBMITTALS

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

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 <Insert drawing designation if any>:

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

   b. MIFAB, Inc.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Dimension of Body: Nominal 14-inch (357-mm) diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
7. Outlet: Bottom.
8. Extension Collars: Required.
10. Expansion Joint: Required.
11. Sump Receiver Plate: Required.
13. Perforated Gravel Guard: [Stainless steel] [Not required].
15. Water Dam: [Not required] [2 inches (51 mm) high].

B. Cast-Iron, Medium-Sump, General-Purpose Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Light Commercial Products Operation.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Dimension of Body: [8- to 12-inch (203- to 305-mm)] diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
7. Outlet: Bottom.
8. Extension Collars: Required.
10. Expansion Joint: Required.
11. Sump Receiver Plate: Required.
14. Perforated Gravel Guard: [Stainless steel] [Not required].
15. Vandal-Proof Dome: Required.
16. Water Dam: [Not required] [2 inches (51 mm) high].

C. Cast-Iron, Small-Sump, General-Purpose Roof Drains <Insert drawing designation if any>: 
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
b. MIFAB, Inc.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Light Commercial Products Operation.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Dimension of Body: Nominal 8-inch (203-mm) diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Outlet: Bottom.
7. Extension Collars: Required.
8. Underdeck Clamp: Required.
10. Sump Receiver Plate: Required.
12. Wire Mesh: Not required.

D. Metal, [Cornice] [and] [Gutter] Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
b. MIFAB, Inc.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for [cornice] [and] [gutter] roof drains.
4. Dimension of Body: Nominal 6-inch (152-mm) diameter.
5. Outlet: [Bottom] [Side] [45-degree angle].

E. Metal, Parapet Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
b. MIFAB, Inc.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for parapet roof drains.
3. Body Material: [Cast iron].
4. Outlet: [Back] [Angle].
5. Grate Material: Cast iron.

F. Metal, Large-Sump, Promenade Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for promenade roof drains.
4. Dimension of Body: Nominal 14-inch (357-mm) diameter.
5. Dimension of Frame and Grate: Nominal 14 inches (357 mm) square.
6. Outlet: Bottom.
7. Grate Material: Cast iron.
8. Vandal-Proof Grate: Not required.
10. Underdeck Clamp: Required.
11. Expansion Joint: Required.
12. Sump Receiver Plate: Required.

G. Metal, Medium-Sump, Promenade Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for promenade roof drains.
4. Dimension of Body: 11- to 12-inch (280- to 305-mm) diameter.
5. Dimension of Frame and Grate: Nominal 12 inches (305 mm) square.
6. Outlet: Bottom.
7. Grate Material: Cast iron.
8. Vandal-Proof Grate: Not required.
10. Underdeck Clamp: Required.
11. Expansion Joint: Required.
12. Sump Receiver Plate: Required.

H. Metal, Small-Sump, Promenade Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   c. Tyler Pipe.
   d. Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; Light Commercial Products Operation.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for promenade roof drains.
4. Dimension of Body: Nominal 8-inch (203-mm) diameter.
5. Dimension of Frame and Grate: Nominal 8 inches (203 mm) square.
6. Outlet: Bottom.
7. Grate Material: Cast iron.
8. Vandal-Proof Grate: Not required.
10. Underdeck Clamp: Required.
11. Expansion Joint: Required.
12. Sump Receiver Plate: Required.

I. Metal, Medium-Sump, Deck Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
5. Clamping Device: Required.
6. Integral Backwater Valve: Not required.
7. Outlet: [Bottom] [End] [Side].
8. Grate Material: Cast iron.
10. Overall Dimension of Frame and Grate: Nominal 14 inches (357 mm) [round] [square].

J. Metal, Small-Sump, Deck Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
5. Clamping Device: Required.
6. Integral Backwater Valve: Not required.
7. Outlet: [Bottom] [End] [Side].
8. Grate Material: Cast iron.
10. Overall Dimension of Frame and Grate: Nominal 8 inches (203 mm) [round] [square].
11. Top-Loading Classification: [Extra-Heavy Duty] [Heavy Duty] [Light Duty] [Medium Duty].

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors <Insert drawing designation if any>:

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 <Insert drawing designation if any>:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.

C. Conductor Nozzles <Insert drawing designation if any>:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.
2.3  CLEANOUTS

A.  Floor Cleanouts <Insert drawing designation if any>:

1.  Manufacturers:  Subject to compliance with requirements, provide products by one of the following:
   b.  Oatey.
   c.  Sioux Chief Manufacturing Company, Inc.
   e.  Tyler Pipe.
   f.  Watts Water Technologies, Inc.
   g.  Zurn Plumbing Products Group; Light Commercial Products Operation.
   h.  Zurn Plumbing Products Group; Specification Drainage Operation.

2.  Standard: ASME A112.36.2M, for [adjustable housing] [cast-iron soil pipe with cast-iron ferrule] [heavy-duty, adjustable housing] [threaded, adjustable housing] cleanouts.

3.  Size:  Same as connected branch.

4.  Type:  [Adjustable housing] [Cast-iron soil pipe with cast-iron ferrule] [Heavy-duty, adjustable housing] [Threaded, adjustable housing].

5.  Body or Ferrule Material:  [Cast iron] [Stainless steel].

6.  Clamping Device:  [Not required] [Required].

7.  Outlet Connection:  [Inside calk] [Spigot] [Threaded].

8.  Closure:  [Brass plug with straight threads and gasket] [Brass plug with tapered threads] [Cast-iron plug] [Plastic plug].

9.  Adjustable Housing Material:  Cast iron with [threads] [set-screws or other device].

10. Frame and Cover Material and Finish:  [Nickel-bronze, copper alloy] [Painted cast iron] [Polished bronze] [Rough bronze] [Stainless steel].

11. Frame and Cover Shape:  [Round] [Square].

12. Top-Loading Classification:  [Extra-Heavy Duty] [Heavy Duty] [Light Duty] [Medium Duty].

13. Riser:  ASTM A 74, [Extra-Heavy] [Service] class, cast-iron drainage pipe fitting and riser to cleanout.

B.  Test Tees <Insert drawing designation if any>:

1.  Manufacturers:  Subject to compliance with requirements, provide products by one of the following:
   b.  MIFAB, Inc.
   d.  Tyler Pipe.
   e.  Watts Water Technologies, Inc.
   f.  Zurn Plumbing Products Group; Specification Drainage Operation.

2.  Standard:  ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.

3.  Size:  Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: [Countersunk] [or] [raised head], [brass].
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
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 <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Size: Same as connected piping.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: [Hub and spigot] [or] [hubless].
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang [closed] [open for airflow unless subject to backflow condition].
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. Cast-Iron, Drain-Outlet Backwater Valves: 

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   c. Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

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

2.5 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

5. Clamping Device: Required.
6. Outlet: [Bottom] [End] [Side].
7. Grate Material: [Ductile iron] [or] [gray iron].

2.6 CHANNEL DRAINAGE SYSTEMS

A. Narrow, Sloped-Invert, Polymer-Concrete, Channel Drainage Systems: 

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. **ABT, Inc.**
b. **ACO USA.**
c. **Mea-Josam Div.; Josam Company.**
d. **MultiDrain Systems.**
e. **Poly-Cast.**
f. **Smith, Jay R. Mfg. Co.**

2. **Type:** Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. **Channel Sections:** Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

1) **Dimensions:** 4-inch (102-mm) inside width. Include number of units required to form total lengths indicated.
2) **Frame:** [Galvanized steel or gray iron for grates] [Not required].

b. **Grates:** Manufacturer's designation "[heavy] [medium] duty,” with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) **Material:** [Ductile iron] [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel].
2) **Locking Mechanism:** [Manufacturer's standard device for securing grates to channel sections] [Not required].

c. **Covers:** Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

d. **Supports, Anchors, and Setting Devices:** Manufacturer's standard unless otherwise indicated.

e. **Channel-Section Joining and Fastening Materials:** As recommended by system manufacturer.

B. **Narrow, Level-Invert, Polymer-Concrete, Channel Drainage Systems <Insert drawing designation if any>:**

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

a. **ABT, Inc.**
b. **ACO USA.**
c. **Mea-Josam Div.; Josam Company.**

2. **Type:** Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. **Channel Sections:** Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 (DN 100) outlets in number and locations indicated.
1) Dimensions: \textbf{5-inch (127-mm)} inside width and \textbf{9-3/4-inch (248-mm)} depth. Include number of units required to form total lengths indicated.

2) Frame: \textbf{[Galvanized steel or gray iron for grates]} [\textbf{Not required}].

b. Grates: Manufacturer's designation "\textbf{[heavy]} \textbf{[medium]} duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: \textbf{[Ductile iron]} \textbf{[Fiberglass]} \textbf{[Galvanized steel]} \textbf{[Gray iron]} \textbf{[Stainless steel]}.

2) Locking Mechanism: \textbf{[Manufacturer's standard device for securing grates to channel sections]} [\textbf{Not required}].

c. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

d. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

C. Wide, Level-Invert, Polymer-Concrete, Channel Drainage Systems \textit{<Insert drawing designation if any>}: 

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

a. \textbf{ABT, Inc}.

b. \textbf{ACO USA}.

c. \textbf{Mea-Josam Div.; Josam Company}.

d. \textbf{Poly-Cast}.

2. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. Channel Sections: Wide, interlocking-joint, precast, polymer-concrete modular units with end caps. Include flat or rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.

1) Dimensions: \textbf{8-inch (203-mm)} inside width and \textbf{13-3/4-inch (350-mm)} depth. Include number of units required to form total lengths indicated.

2) Frame: \textbf{[Galvanized steel or gray iron for grates]} [\textbf{Not required}].

b. Grates: Manufacturer's designation "\textbf{[heavy]} \textbf{[medium]} duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: \textbf{[Ductile iron]} \textbf{[Fiberglass]} \textbf{[Galvanized steel]} \textbf{[Gray iron]} \textbf{[Stainless steel]}.

2) Locking Mechanism: \textbf{[Manufacturer's standard device for securing grates to channel sections]} [\textbf{Not required}].

c. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
d. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
   1. Refer to “Cleveland Clinic Firestopping and Fireproofing Performance Based Standard” for requirements.

2.8 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to 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 (152 mm)] [12 inches (305 mm)] [18 inches (457 mm)] above grade. Secure to building wall.
D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

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 according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

N. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

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

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423
SECTION 221429 - SUMP 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. Submersible sump pumps.
      2. Wet-pit-volute sump pumps.
      4. Packaged drainage-pump units.

   B. Related Section:
      1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated. [Include construction details, material descriptions, dimensions of individual components and profiles.] [Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.]

   B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

   B. UL Compliance: Comply with UL 778 for motor-operated water pumps.
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 rigging instructions for handling.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

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

   a. *Barnes; Crane Pumps & Systems.*
   b. *Bell & Gossett Domestic Pump; ITT Corporation.*
   c. *Pentair Pump Group; Hydromatic Pumps.*
   e. *Zoeller Company.*

2. Description: Factory-assembled and -tested sump-pump unit.

3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], semiopen design for clear wastewater handling, and keyed and secured to shaft.


7. Seal: Mechanical.

8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: [Air] [Oil].

9. Controls:

   a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
   b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

B. Submersible, Fixed-Position, Double-Seal Sump Pumps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BJM Pumps, LLC.
   b. EBARA Fluid Handling.
   c. ITT Flygt Corporation.
   d. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], semiopen design for clear wastewater handling, and keyed and secured to shaft.
7. Seals: Mechanical.
8. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
9. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   a. Motor Housing Fluid: [Air] [Oil].
10. Controls:
    a. Enclosure: NEMA 250, [Type 1] [Type 4X]; [pedestal] [wall]-mounted.
    b. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
11. Control-Interface Features:
   
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      
      1) On-off status of pump.
      2) Alarm status.

2.2 WET-PIT-VOLUTE SUMP PUMPS

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

1. Alyan Pump Company.
2. Armstrong Pumps Inc.
3. Chicago Pump Company; a division of Yeomans Chicago Corporation.
4. Federal Pump Corp.
5. Flo Fab inc.
6. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
7. Peerless Pump, Inc.
8. Pentair Pump Group; Aurora Pump.
10. Tramco Pump Company.
13. Weinman Division; Crane Pumps & Systems.

B. Description: Factory-assembled and -tested sump-pump unit.

C. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

D. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 (DN 50) and smaller and flanged connection for NPS 2-1/2 (DN 65) and larger discharge piping.

E. Impeller: Statically and dynamically balanced, [ASTM A 48/A 48M, Class No. 25 A cast iron] [ASTM A 532/A 532M, abrasion-resistant cast iron] [and] [ASTM B 584, cast bronze], semiopen design for clear wastewater handling, and keyed and secured to shaft.

F. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.
G. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

H. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings.

I. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sump-Pump Basins and Basin Covers" Article for requirements.

J. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

K. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.

L. Controls:
   1. Enclosure: NEMA 250, [Type 1] [Type 4X]: [pedestal] [wall]-mounted.
   2. Switch Type: [Mechanical-float] [Mercury-float] [Pressure] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   4. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

M. Control-Interface Features:
   1. Remote Alarm Contacts: For remote alarm interface.
   2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      a. On-off status of pump.
      b. Alarm status.

2.3 SUMP PUMP CAPACITIES AND CHARACTERISTICS

A. Unit Capacity: <Insert gpm (L/minute)>.

B. Number of Pumps: [One] [Two].

C. Each Pump:
   1. Capacity: <Insert gpm (L/minute)>.
   2. Total Dynamic Head: <Insert feet (kPa)>.
   3. Speed: <Insert rpm>.
   4. Discharge Size: <Insert NPS (DN)>.
   5. Electrical Characteristics:
b. Volts: [120] [240] [277] [480].
c. Phases: [Single] [Three].
d. Hertz: 60.

D. Unit Electrical Characteristics:
   1. Full-Load Amperes: <Insert value>.
   3. Maximum Overcurrent Protection: <Insert value> A.

2.4 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
   1. Material: [Cast iron] [Concrete].
   2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
   3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
   1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

C. Capacities and Characteristics:
   1. Capacity: <Insert gal (L)>.
   2. Diameter: <Insert inches (mm)>
   3. Depth: <Insert inches (mm)>
   4. Inlet No. 1:
      a. Drainage Pipe Size: <Insert NPS (DN)>
      b. Bottom of Sump to Centerline: <Insert inches (mm)>
      c. Type: [Flanged] [Hubbed] [Threaded] outside.
   5. Inlet No. 2:
      a. Drainage Pipe Size: <Insert NPS (DN)>
      b. Bottom of Sump to Centerline: <Insert inches (mm)>
      c. Type: [Flanged] [Hubbed] [Threaded] outside.
   6. Inlet No. 3:
      a. Drainage Pipe Size: <Insert NPS (DN)>
      b. Bottom of Sump to Centerline: <Insert inches (mm)>
      c. Type: [Flanged] [Hubbed] [Threaded] outside.
7. Sidewall Outlet:
   a. Discharge Pipe Size: <Insert NPS (DN)>.
   b. Bottom of Sump to Centerline: <Insert inches (mm)>.
   c. Type: [Hubbed inside] [Hubbed outside].

8. Cover Material: Cast iron or steel with bituminous coating.
9. Cover Diameter: <Insert inches (mm)>, but not less than outside diameter of basin top flange.
10. Manhole Required in Cover: Yes.
11. Vent Size: [Not required] <Insert NPS (DN)>.

2.5 PACKAGED DRAINAGE-PUMP UNITS

A. Packaged Pedestal Drainage-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Zoeller Company.
   2. Description: Factory-assembled and -tested, automatic-operation, freestanding, sump-pump unit.
   3. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Corrosion-resistant material, with strainer inlet, design that permits flow into impeller, and vertical discharge for piping connection.
   5. Impeller: Aluminum, brass, or plastic.
   7. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.

B. Packaged Submersible Drainage-Pump Units:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABS Pumps Inc.
      b. Bell & Gossett Domestic Pump; ITT Corporation.
      c. Glentronics, Inc.
      d. Goulds Pumps; ITT Corporation.
      e. Grundfos Pumps Corp.
      f. Liberty Pumps.
      g. Little Giant Pump Co.
      h. McDonald, A. Y. Mfg. Co.
      i. Pentair Pump Group; Hydromatic Pumps.
      j. Pentair Pump Group; Myers.
2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
5. Impeller: [Brass] [Stainless Steel].
6. Pump Seal: Mechanical.
8. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.
9. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings.

C. Capacity and Characteristics:

1. Capacity: <Insert gpm (L/minute)>
2. Total Dynamic Head: <Insert feet (kPa)>
3. Speed: <Insert rpm>
4. Discharge Pipe Size: <Insert NPS (DN)>
5. Electrical Characteristics:
   a. Motor Horsepower: <Insert value>
   b. Volts: [120] [240] [277] [480]
   c. Phases: [Single] [Three]
   d. Hertz: 60
   e. Full-Load Amperes: <Insert value>
   f. Minimum Circuit Ampacity: <Insert value>
   g. Maximum Overcurrent Protection: <Insert value> A

[Retain first subparagraph below for packaged pedestal drainage-pump units.]


[Retain subparagraph below for packaged submersible drainage-pump units.]

7. Basin:
   a. Capacity: [2 gal (7.6 L)] [5 gal (18.9 L)] minimum.
   b. Inlet Connection: [NPS 1-1/2 (DN 40)] minimum.

2.6 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.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK
A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION
A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION
A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

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

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL
A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.
3.6 STARTUP SERVICE
   A. Engage a factory-authorized service representative to perform startup service.
      1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING
   A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
   B. Adjust control set points.

3.8 DEMONSTRATION
   A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429
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, atmospheric, gas-fired, storage, domestic-water heaters.
2. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
3. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
5. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.
1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification 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.

B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 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, "Drinking Water System Components - Health Effects."
1.8 COORDINATION

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

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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.
   b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-Fired, STORAGE, domestic-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Lochinvar Corporation.
   c. PVI Industries, LLC.
   d. Rheem Manufacturing Company.
   e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   f. State Industries.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Lining: [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. 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 complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, 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-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.


B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:

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

a. PVI Industries, LLC.
b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
c. State Industries.


a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Lining: [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. 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 complying with ASSE 1005.

d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.

e. Jacket: Steel with enameled finish.


g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, 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-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.


C. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

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


b. Lochinvar Corporation.

c. Rheem Manufacturing Company.

d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

e. State Industries.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. 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 complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, 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-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

D. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. [Bradford White Corporation](https://www.bradfordwhite.com).
   b. [Lochinvar Corporation](https://www.lochinvar.com).
   c. [PVI Industries, LLC](https://www.pviindustries.com).
   d. [Rheem Manufacturing Company](https://www.rheem.com).
   e. [Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation](https://www.aosh.com).
f. State Industries.

3. Description: Manufacturer's proprietary design to provide at least \[84\] \[85\] \[88\] \[95\] percent combustion efficiency at optimum operating conditions.
   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
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 complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
   g. Temperature Control: Adjustable thermostat.
   h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
   i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

E. Capacity and Characteristics:

1. Capacity: \(<\text{Insert gal. (L)}>\).
2. Recovery: \(<\text{Insert gph (L/s)}>\) at 100 deg F (56 deg C) temperature rise.
3. Temperature Setting: \([125\ \text{deg F (52 deg C)}]\) \([140\ \text{deg F (60 deg C)}]\).
4. Fuel Gas Demand: \(<\text{Insert cfh (L/s)}>\).
5. Fuel Gas Input: \(<\text{Insert Btu/h (W)}>\).
6. Gas Pressure Regulator:
   a. Capacity: \(<\text{Insert cfh (L/s)}>\).
b. Inlet Pressure: <Insert psig (kPa) or inches (mm)> water column.
c. Gas Pressure Required at Burner: <Insert psig (kPa) or inches (mm)> water column.

7. Electrical Characteristics:

a. Volts: [120] [240] [277] [480].
b. Phase: [Single] [Three].
c. Hertz: 60.
d. Full-Load Amperes: <Insert value>.
e. Minimum Circuit Ampacity: <Insert value>.
f. Maximum Overcurrent Protection: <Insert amperage>.

8. Minimum Vent Diameter: <Insert inches (mm)>.

2.2 Domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

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

a. AMTROL Inc.
b. Pentair Pump Group (The); Myers.
c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
d. State Industries.
e. Taco, Inc.

2. 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.

3. 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: [100 psig (690 kPa)] [150 psig (1035 kPa)].
c. Air Precharge Pressure: <Insert system pressure>.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1[ or ASHRAE 90.2].

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and [calibrated] [memory-stop] balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."


G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include [1/2-psig (3.5-kPa)] [2-psig (13.8-kPa)] [5-psig (34.5-kPa)] pressure rating as required to match gas supply.


I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

J. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

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 a minimum of 18 inches (457 mm) 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.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to 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. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

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." ] [Section 033053 "Miscellaneous 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 (450-mm) 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, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to 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 commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. 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."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping." and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 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. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 Demonstration

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400
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:
   2. Domestic-water, heat-exchanger accessories.

1.3 PERFORMANCE REQUIREMENTS
A. Seismic Performance: Domestic-water heat exchangers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS
A. Product Data: For each type and size of domestic-water heat exchanger indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS
A. Seismic Qualification Certificates: For domestic-water heat exchangers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of shell-and-tube, domestic-water heat exchanger, from manufacturer.

C. Domestic-Water, Heat-Exchanger Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic-water heat exchangers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

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

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including heat exchanger, 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. Shell-and-Tube, Domestic-Water Heat Exchangers:
      1) Tube Coil: One year.
      2) Controls and Other Components: One year.
   b. Compression Tanks: One year.

PART 2 - PRODUCTS

2.1 SHELL-AND-TUBE, DOMESTIC-WATER HEAT EXCHANGERS

A. Shell-and-Tube, Domestic-Water-in-Coil, Domestic-Water Heat Exchangers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Graham Corporation.
      b. Leslie Controls, Inc.
   2. PVI Industries, LLC. Description: Tankless, packaged assembly of heat-exchanger coils, controls, and specialties for heating domestic water in coils with steam in shell.
   3. Construction: ASME code, with [cast-iron] [or] [steel] shell for steam.
      a. Cast-Iron Shell Pressure Rating: [50 psig (345 kPa)] [75 psig (517 kPa)].
      b. Steel Shell Pressure Rating: 150 psig (1035 kPa).
      c. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire shell and nozzle except connections and controls.
      d. Tube thickness: .49 inches.
   5. Temperature Control: Adjustable thermostat that operates steam-control valve and is capable of maintaining outlet-water temperature within 3 deg F (2 deg C) of setting.
   6. Safety Control: Automatic, high-temperature-limit cutoff device or system.
   7. Miscellaneous Components: Strainers, steam-control valve, steam trap, valves, and piping.
   8. Stand: Factory fabricated for floor mounting.

B. Capacity and Characteristics:
   1. Flow Rate: <Insert gpm (L/s)> at 100 deg F (56 deg C) temperature rise.
   2. Hot-Water Temperature Setting: <Insert deg F (deg C)>.
   3. Domestic-Water Pipe Size: <Insert NPS (DN)>.
   4. Electronic control.
   5. Recirculation pump
a. Flow rate: Insert gpm
b. Pressure: insert psi

6. Heating Hot-Water Supply:

a. Inlet Temperature: \textless Insert deg F (deg C)\textgreater.
b. Outlet Temperature: \textless Insert deg F (deg C)\textgreater.
c. Pipe Size: \textless Insert NPS (DN)\textgreater.

7. Steam Supply:

a. Inlet Pressure: \textless Insert psig (kPa)\textgreater.
b. Demand Rate: \textless Insert lb/h (kg/s)\textgreater.
c. Input Rating: \textless Insert Btu/h (kW)\textgreater.
d. Steam Pipe Size: \textless Insert NPS (DN)\textgreater.
e. Valve Turndown: Insert

8. Condensate Pipe Size: \textless Insert NPS (DN)\textgreater.

9. Electrical Characteristics:

a. Volts: \textless Insert value\textgreater.
b. Phases: \textless Insert value\textgreater.
c. Hertz: \textless Insert value\textgreater.
d. Full-Load Amperes: \textless Insert value\textgreater.
e. Minimum Circuit Ampacity: \textless Insert value\textgreater.
f. Maximum Overcurrent Protection: \textless Insert amperage\textgreater.

2.2 DOMESTIC-WATER, HEAT-EXCHANGER ACCESSORIES

A. Domestic-Water Compression Tanks:

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

a. AMTROL Inc.
c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
d. State Industries.
e. Taco, Inc.

2. 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.

3. 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.
4. Capacity and Characteristics:
   a. Working-Pressure Rating: [100 psig (690 kPa)] [150 psig (1035 kPa)].
   c. Air Precharge Pressure: <Insert system pressure>.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1[ or ASHRAE 90.2].

C. Heat-Trap Fittings: ASHRAE 90.2.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than heat-exchanger working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than heat-exchanger working-pressure rating.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heat exchangers specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heat exchangers will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER, HEAT-EXCHANGER INSTALLATION

A. Domestic-Water, Heat-Exchanger Mounting: Install domestic-water heat exchangers on concrete base. Comply with requirements for concrete bases specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) 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.
5. Anchor heat exchangers to substrate.

B. Install domestic-water heat exchangers level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to heat exchangers and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install shutoff valves on heating hot-water piping to heat exchangers. Comply with requirements for shutoff valves specified in Section 230523 "General-Duty Valves for HVAC Piping."
3. Install shutoff valves on steam and condensate piping to heat exchangers. Comply with requirements for shutoff valves specified in Section 230523 "General-Duty Valves for HVAC Piping."

C. Install domestic-water heat exchangers with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install temperature and pressure relief valves in top portion of storage-tank shells of domestic-water heat exchangers with domestic-water storage. Use relief valves with sensing elements that extend into shells. Extend 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 heat exchangers without storage. Extend 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 heat-exchanger 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 heat exchangers 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 each domestic-water, heat-exchanger, inlet and outlet piping, and install thermometer on each domestic-water, heat-exchanger, heating-fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install pressure gages on domestic-water, heat-exchanger, heating-fluid piping. Comply with requirements for pressure gages specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Fill domestic-water heat exchangers with water.
J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for heating hot-water piping specified in Section 232113 "Hydronic Piping."

C. Comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to domestic-water heat exchangers, allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of domestic-water heat exchangers.

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. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heat exchangers will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain shell-and-tube domestic-water heat exchangers.
END OF SECTION 223500
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. Water closets.
   2. Flushometer valves.
   3. Toilet seats.

B. Related Requirements:
   1. Section 224300 "Medical Plumbing Fixtures" for healthcare water closets.
   2. Section 224600 "Security Plumbing Fixtures" for security water closets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
   1. Product Data for Prerequisite WE 1[ and Credit WE 3] [Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.
1.5 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 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets <Insert drawing designation>: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Mansfield Plumbing Products LLC.
   f. Sloan.
   g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: [Standard] [Child] [Handicapped/elderly, complying with ICC/ANSI A117.1].
   f. Rim Contour: Elongated.
   g. Water Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
   i. Color: [White] [Bone].

3. Bowl-to-Drain Connecting Fitting: [ASTM A 1045 or ]ASME A112.4.3.

B. Water Closets <Insert drawing designation>: Floor mounted, bottom outlet, back spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Sloan.
c. Kohler Co.
d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.

3. Water Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.
   a. Spud Size and Location: NPS 1-1/2 (DN 40); back.
   b. Color: [White] [Bone].

4. Bowl-to-Drain Connecting Fitting: [ASTM A 1045 or ]ASME A112.4.3.
5. Flushometer Valve: <Insert flushometer-valve designation>.

C. Water Closets <Insert drawing designation>: Floor mounted, bottom outlet, child's.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Sloan.
   c. Crane Plumbing, L.L.C.
   d. Kohler Co.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet or reverse trap.
   d. Style: Flushometer valve.
   e. Height: Child.
   f. Rim Contour: Modified elongated or regular.
   g. Water Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); back.
   i. Color: [White] [Bone].

3. Bowl-to-Drain Connecting Fitting: [ASTM A 1045 or ]ASME A112.4.3.
5. Toilet Seat: IAPMO/ANSI Z124.5, Type A (residential), Shape 3 (elongated rim), open front, without cover, and shaped to match bowl.
2.2 FLOOR-MOUNTED, BACK-OUTLET WATER CLOSETS

A. Water Closets <Insert drawing designation>: Floor mounted, back outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.
   e. Sloan.

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. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
   i. Color: [White] [Bone].

5. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.[ Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]

B. Water Closets <Insert drawing designation>: Floor mounted, back outlet, back spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Kohler Co.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.
   d. Sloan.

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: \[1.28 \text{ gal. (4.8 L)} \] \[1.6 \text{ gal. (6 L)} \] per flush.
h. Spud Size and Location: NPS 1-1/2 (DN 40); back.
i. Color: [White] [Bone].

3. Flushometer Valve: \(<\text{Insert flushometer-valve designation}>\).
4. Toilet Seat: \(<\text{Insert toilet-seat designation}>\).
5. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.[Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]

2.3 WALL-MOUNTED WATER CLOSETS

A. Water Closets \(<\text{Insert drawing designation}>\): Wall mounted, top spud[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Kohler Co.
   c. Mansfield Plumbing Products LLC.
   d. Sloan.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.
   g. Water Consumption: \[1.28 \text{ gal. (4.8 L)} \] \[1.6 \text{ gal. (6 L)} \] per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

3. Flushometer Valve: \(<\text{Insert flushometer-valve designation}>\).
4. Toilet Seat: \(<\text{Insert toilet-seat designation}>\).
5. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.[Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]
c. Water-Closet Mounting Height: [Standard] [Child] [Handicapped/elderly according to ICC/ANSI A117.1].

B. Water Closets <Insert drawing designation>: Wall mounted, back spud[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Sloan.
   f. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   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. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); back.


5. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.[Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]
   c. Water-Closet Mounting Height: [Standard] [Child] [handicapped/elderly height according to ICC/ANSI A117.1].

2.4 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves <Insert designation>: 

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delta.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.

B. Solenoid-Actuator, Diaphragm Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delta.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
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: Hard-wired 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. (4.8 L)] [1.6 gal. (6 L)] per flush.

C. Lever-Handle, Piston Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delta.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.

D. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delta.
   b. Moen Incorporated.
   c. Sloan Valve Company.
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
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: Hard-wired 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. (4.8 L)] [1.6 gal. (6 L)] per flush.

2.5 TOILET SEATS

A. Toilet Seats <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bemis Manufacturing Company.
   c. Church Seats.
   e. Kohler Co.
   f. Olsonite Seat Co.
   g. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Type: [Commercial (Standard)] [Commercial (Heavy duty)].
5. Shape: [Elongated rim, open front] [Elongated rim, closed front].
6. Hinge: [Check] [Self-sustaining] [Self-sustaining, check] [Self-raising].
8. Seat Cover: [Required] [Not required].
9. Color: [White] [Black].

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

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. Carrier shall be rated for fixture weight rating as a minimum.
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.

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.

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 Cleveland Clinic.

END OF SECTION 224213.13
SECTION 224213.16 - COMMERCIAL URINALS

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. Urinals.
   2. Flushometer valves.

B. Related Requirements:
   1. Section 224600 "Security Plumbing Fixtures" for security urinals.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
   1. Product Data for Prerequisite WE 1[ and Credit WE 3] [, Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

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

1.5 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 STALL URINALS

A. Urinals <Insert drawing designation>: Stall, washout type.

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

   b. Kohler Co.
   c. Sloan Valve Company
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.

   [Caution: This type of urinal requires a drainage piping trap under the urinal. This trap is not part of the urinal fittings.]

2. Fixture:

   b. Material: Vitreous china.
   c. Type: Straight or sloped front.
      [Retain "Seam Covers" Subparagraph below if two or more stall urinals will be installed side by side.]
   d. Seam Covers: For [21-inch (535-mm)] [24-inch (610-mm)] urinal centers.
   e. Strainer: Separate; removable.
   g. Spud Size and Location: NPS 3/4 (DN 20); top.
   h. Outlet Size and Location: NPS 2 (DN 50); bottom for separate trap.
   i. Color: [White] [Bone].


2.2 WALL-HUNG URINALS

A. Urinals <Insert drawing designation>: Wall hung, back outlet, blowout.

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

   b. Kohler Co.
   c. Sloan Valve Company
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Fixture:
   b. Material: Vitreous china.
   c. Strainer or Trapway: [Manufacturer's standard strainer] [Open trapway] with integral trap.
   e. Spud Size and Location: NPS 1-1/4 (DN 32); [back] [top].
   f. Outlet Size and Location: NPS 2 (DN 50); back.
   g. Color: [White] [Bone].


4. Waste Fitting:
   b. Size: NPS 2 (DN 50).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. [Include rectangular, steel uprights.]

B. Urinals <Insert drawing designation>: Wall hung, back outlet, siphon jet[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Briggs Plumbing Products, Inc.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Mansfield Plumbing Products LLC.
   f. Sloan Valve Company.
   g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Material: Vitreous china.
   c. Type: Siphon jet[ with extended shields].
   d. Water Consumption: [Water saving] [Low].
   e. Spud Size and Location: NPS 3/4 (DN 20); [back] [top].
   f. Outlet Size and Location: NPS 2 (DN 50); back.
   h. Color: [White] [Bone].
b. Size: NPS 2 (DN 50).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.[Include rectangular, steel uprights.]

C. Urinals <Insert drawing designation>: Wall hung, back outlet, washout[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Briggs Plumbing Products, Inc.
   c. Crane Plumbing, L.L.C.
   d. Gerber Plumbing Fixtures LLC.
   e. Kohler Co.
   f. Mansfield Plumbing Products LLC.
   g. Sloan Valve Company.
   h. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   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] [Low].
   f. Spud Size and Location: NPS 3/4 (DN 20), [back] [top].
   g. Outlet Size and Location: NPS 2 (DN 50), back.
   h. Color: [White] [Bone].


4. Waste Fitting:
   b. Size: NPS 2 (DN 50).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.[Include rectangular, steel uprights.]

D. Urinals <Insert drawing designation>: Wall hung, bottom outlet, washout.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Briggs Plumbing Products, Inc.
   c. Kohler Co.
   d. Mansfield Plumbing Products LLC.
2. Fixture:
   b. Material: Vitreous china.
   c. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 (DN 40) tailpiece.
   d. Strainer or Trapway: Manufacturer's standard strainer and NPS 1-1/2 (DN 40) tailpiece.
   e. Design Consumption: [Water saving] [Low].
   f. Inlet Spud Size and Location: NPS 3/4 (DN 20); top.
   g. Outlet Size and Location: NPS 1-1/2 (DN 40); bottom.
   h. Color: [White] [Bone].


4. Waste Fitting:
   b. Trap:
      1) Size: NPS 1-1/2 (DN 50).
      2) Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [one-piece, cast-brass trap with swivel 0.029-inch- (73-mm-) thick tubular brass wall bend]; and chrome-plated brass or steel wall flange.

5. Support: ASME A112.6.1M, Type II, urinal carrier with hanger and bearing plates.[ Include rectangular, steel uprights.]

E. Urinals <Insert drawing designation>: Wall hung, bottom outlet, wash down.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Kohler Co.
   c. Sloan Valve Company.
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Material: Enameled cast iron.
   c. Style: Wash sink with back and without pedestal modified for use as urinal.
   d. Size: [36 inches (915 mm)] [48 inches (1219 mm)] [60 inches (1525 mm)] [72 inches (1830 mm)].
2.3 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **Delta**.
   b. **Sloan Valve Company**.
   c. **Zurn Industries, LLC; Commercial Brass and Fixtures**.

3. Minimum Pressure Rating: **125 psig (860 kPa)**.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Consumption: **[0.5 gal. (1.9 L)] [1.0 gal. (3.8 L)]** per flush.
10. Minimum Inlet: **[NPS 3/4 (DN 20)] [NPS 1 (DN 25)]**.
B. Solenoid-Actuator, Diaphragm Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Delta.
b. Sloan Valve Company.
c. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: [0.5 gal. (1.9 L)] [1.0 gal. (3.8 L)] per flush.
12. Minimum Inlet: [NPS 3/4 (DN 20)] [NPS 1 (DN 25)].

C. Lever-Handle, Piston Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Delta.
b. Sloan Valve Company.
c. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Consumption: [0.5 gal. (1.9 L)] [1.0 gal. (3.8 L)] per flush.
10. Minimum Inlet: [NPS 3/4 (DN 20)] [NPS 1 (DN 25)].
11. Minimum Outlet: [NPS 3/4 (DN 20)] [NPS 1-1/4 (DN 32)].

D. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves <Insert designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Delta.
b. Moen Incorporated.
c. Sloan Valve Company.
d. Zurn Industries, LLC; Commercial Brass and Fixtures.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Exposed] [Concealed].
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: [0.5 gal. (1.9 L)] [1.0 gal. (3.8 L)] per flush.
12. Minimum Inlet: [NPS 3/4 (DN 20)] [NPS 1 (DN 25)].

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.

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.

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.

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 Cleveland Clinic.

END OF SECTION 224213.16
SECTION 224216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
   2. Shampoo bowls.
   3. Faucets.

B. Related Requirements:
   1. Section 224300 "Medical Plumbing Fixtures" for healthcare lavatories.
   2. Section 224600 "Security Plumbing Fixtures" for security lavatories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
   1. Product Data for Prerequisite WE 1[ and Credit WE 3] [Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.
1.5 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.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory <Insert drawing designation>: Rectangular, self-rimming, vitreous china, counter mounted.

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

      b. Crane Plumbing, L.L.C.
      c. Kohler Co.
      d. Mansfield Plumbing Products LLC.

   2. Fixture:

      b. Type: Self-rimming for above-counter mounting.
      c. Nominal Size: Rectangular, [21 by 19 inches (533 by 483 mm)] [24 by 20 inches (610 by 508 mm)].
      d. Faucet-Hole Punching: [One hole] [Three holes, 2-inch (51-mm) centers] [Three holes, 4-inch (102-mm) centers].
      e. Faucet-Hole Location: Top.
      g. Mounting Material: Sealant.

B. Lavatory <Insert drawing designation>: [Oval] [Round], self-rimming, vitreous china, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
   b. Briggs Plumbing Products, Inc.
   c. Crane Plumbing, L.L.C.
   d. Gerber Plumbing Fixtures LLC.
   e. Kohler Co.
   f. Mansfield Plumbing Products LLC.
   g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   
   b. Type: Self-rimming for above-counter mounting.
   c. Nominal Size: Oval, [19 by 17 inches (483 by 432 mm)] [20 by 17 inches (508 by 432 mm)].
   d. Nominal Size: Round, 19 inches (483 mm).
   e. Faucet-Hole Punching: [One hole] [Three holes, 2-inch (51-mm) centers] [Three holes, 4-inch (102-mm) centers].
   f. Faucet-Hole Location: Top.
   g. Color: White.
   h. Mounting Material: Sealant.


C. Lavatory <Insert drawing designation>: Oval, vitreous china, undercounter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
   b. Crane Plumbing, L.L.C.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Mansfield Plumbing Products LLC.
   f. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   
   b. Type: For undercounter mounting.
c. Nominal Size: Oval, [19 by 16 inches (483 by 406 mm)] [22 by 14 inches (559 by 356 mm)] [23 by 15 inches (584 by 381 mm)].

d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
g. Mounting Material: Sealant and undercounter mounting kit.


2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory <Insert drawing designation>: Vitreous china, wall mounted, with back.

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

   b. Briggs Plumbing Products, Inc.
   c. Crane Plumbing, L.L.C.
   d. Gerber Plumbing Fixtures LLC.
   e. Kohler Co.
   f. Mansfield Plumbing Products LLC.
   g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

   b. Type: For wall hanging.
   c. Nominal Size: Oval, [19 by 16 inches (483 by 406 mm)] [22 by 14 inches (559 by 356 mm)] [23 by 15 inches (584 by 381 mm)].
   d. Faucet-Hole Punching: [One hole] [Three holes, 2-inch (51-mm) centers] [Three holes, 4-inch (102-mm) centers].
   e. Faucet-Hole Location: Top.
   g. Mounting Material: Chair carrier.


4. Support: ASME A112.6.1M, [Type I, exposed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier with escutcheons]. [Include rectangular, steel uprights.]

B. Lavatory <Insert drawing designation>: Ledge back, vitreous china, wall mounted.

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

   b. Briggs Plumbing Products, Inc.
c. Crane Plumbing, L.L.C.
d. Gerber Plumbing Fixtures LLC.
e. Kohler Co.
f. Mansfield Plumbing Products LLC.

2. Fixture:
   b. Type: For wall hanging.
   c. Nominal Size: Oval, [19 by 16 inches (483 by 406 mm)] [22 by 14 inches (559 by 356 mm)] [23 by 15 inches (584 by 381 mm)].
   d. Faucet-Hole Punching: [One hole] [Three holes, 2-inch (51-mm) centers] [Three holes, 4-inch (102-mm) centers].
   e. Faucet-Hole Location: Top.
   g. Mounting Material: Chair carrier.


4. Support: ASME A112.6.1M, [Type I, exposed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier with escutcheons]. [Include rectangular, steel uprights.]

C. Lavatory <Insert drawing designation>: Slab type, vitreous china, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Kohler Co.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Type: For wall hanging.
   c. Nominal Size: Oval, [19 by 16 inches (483 by 406 mm)] [22 by 14 inches (559 by 356 mm)] [23 by 15 inches (584 by 381 mm)].
   d. Faucet-Hole Punching: [One hole] [Three holes, 2-inch (51-mm) centers] [Three holes, 4-inch (102-mm) centers].
   e. Faucet-Hole Location: Top.
   g. Mounting Material: Chair carrier.


4. Support: ASME A112.6.1M, [Type I, exposed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier] [Type II, concealed-arm lavatory carrier with escutcheons]. [Include rectangular, steel uprights.]

D. Lavatory <Insert drawing designation>: Wheelchair, vitreous china, wall mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Mansfield Plumbing Products LLC.

2. Fixture:
   b. Type: Slab or wheelchair.
   c. Nominal Size: Rectangular, 27 by 20 inches (686 by 508 mm).
   d. Faucet-Hole Punching: Three holes, 2-inch (51-mm) centers.
   e. Faucet-Hole Location: Top.
   g. Mounting: For concealed-arm carrier.


E. Lavatory <Insert drawing designation>: Corner type, vitreous china, wall mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.

2. Fixture:
   b. Type: Three-sided-front apron with three-sided back.
   c. Nominal Size: Corner, 16 by 16 inches (406 by 406 mm).
   d. Faucet-Hole Punching: Three holes, 2-inch (51-mm) centers.
   e. Faucet-Hole Location: Back wall.
   g. Mounting Materials: Wall brackets.

3. Faucet: Manufacturer's standard; solid brass; factory installed.
4. Support: ASME A112.6.1M, Type III, lavatory carrier with two hanger plates made for corner lavatories. [Include rectangular, steel uprights.]

2.3 SHAMPOO BOWLS
A. Shampoo Bowls <Insert drawing designation>: Plastic.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Belvedere, LLC.
   b. Takara Belmont.

2. Fixture:
   b. Material: [Plastic] [FRP] [PMMA].
   c. Bowl: Shaped for head rest.
   d. Nominal Size: [19 by 19 by 10 inches (483 by 483 by 250 mm)].
   e. Color: White.
   f. Mounting Material: [Bracket or devices for attaching to counter] [Wall bracket].

3. Faucet: Manufacturer's standard with vacuum breaker complying with ASME A112.18.3 and with hose spray head.
4. Waste Fittings: Comply with requirements in "Waste Fittings" Article except as follows:
   a. Drain: Cup type with hair basket and NPS 1-1/2 (DN 40) tailpiece.
   b. Trap Size: NPS 1-1/2 (DN 40).

B. Shampoo Bowls <Insert drawing designation>: Solid-surface material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Willoughby Industries, Inc.

2. Fixture:
   b. Material: Molded, cast polymer.
   c. Bowl: Shaped for head rest.
   d. Nominal Size: [19 by 19 by 9 inches (483 by 483 by 229 mm)] [20 by 18 by 9 inches (508 by 457 by 229 mm)].
   e. Color: [Gray granite] [Sandstone] [White granite].
   f. Mounting Material: [Bracket or devices for attaching to counter] [Wall bracket].

3. Faucet: Manufacturer's standard with vacuum breaker complying with ASME A112.18.3 and with hose spray head.
4. Waste Fittings: Comply with requirements in "Waste Fittings" Article except as follows:
   a. Drain: Cup type with hair basket and NPS 1-1/2 (DN 40) tailpiece.
   b. Trap Size: NPS 1-1/2 (DN 40).
2.4 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets <Insert designation>: Manual-type, [single-control mixing] [single-control nonmixing] [two-handle mixing], [commercial] [general-duty], solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Chicago Faucets.
   b. Delta Faucet Company.
   c. Kohler Co.
   d. Moen Incorporated.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: [Centerset] [Widespread] [Single hole].
6. Finish: [Polished chrome plate].
7. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
8. Maximum Flow: 0.25 gal. (0.95 L) per metering cycle.
9. Mounting Type: [Deck, exposed] [Deck, concealed] [Back/wall, exposed] [Back/wall, concealed].
10. Valve Handle(s): [Single lever] [Knob] [Knob, nonmetallic] [Cross, three arm] [Cross, four arm] [Wrist blade, 4 inches (102 mm)] [Elbow, 6 inches (152 mm)] [Push button].
11. Spout: [Rigid] [Swing] [Rigid, gooseneck] [Swivel, gooseneck] type.
12. Spout Outlet: [Aerator] [Laminar flow] [Spray].
13. Operation: [Compression, manual] [Noncompression, manual].

2.5 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets <Insert designation>: Automatic-type, [battery-powered,] [hard-wired,] electronic-sensor-operated, [mixing] [nonmixing], solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Chicago Faucets.
   b. Kohler Co.
   c. Moen Incorporated.
   d. Sloan Valve Company.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: [Commercial] [General-duty], solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
9. Mounting Type: [Deck, concealed] [Back/wall, concealed].
10. Spout: [Rigid] [Swing] [Rigid, gooseneck] [Swivel, gooseneck] type.
11. Spout Outlet: [Aerator] [Laminar flow] [Spray].

2.6 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

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

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.
3. NEOPERL, Inc.

C. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.7 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "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] [Wheel handle].

F. Risers:

1. NPS 1/2 (DN 15).
2. [Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces] [Chrome-plated, soft-copper flexible tube] [ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose] riser.

2.8 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:
   2. Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [one-piece, cast-brass trap with swivel 0.029-inch- (73-mm-) thick tubular brass wall bend]; and chrome-plated, brass or 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, 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 Cleveland Clinic.

END OF SECTION 224216.13
SECTION 224216.16 - COMMERCIAL SINKS

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. Service basins.
      2. Service sinks.
      4. Handwash sinks.
      5. Sacristy sinks.
      6. Sink faucets.
      7. Laminar-flow, faucet-spout outlets.
      8. Supply fittings.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
      2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

   B. LEED Submittals:
      1. Product Data for Prerequisite WE 1[ and Credit WE 3] [, Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

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

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For sinks to include in maintenance manuals.
1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins <Insert drawing designation>: Terrazzo, floor mounted.

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

   b. Crane Plumbing, L.L.C.
   c. Florestone Products Co., Inc.
   d. Stern-Williams Co., Inc.

2. Fixture:

   b. Shape: [Square] [Rectangular] [Five sided] [Radial front].
   c. Nominal Size: [24 by 24 inches (610 by 610 mm)] [30 by 30 inches (762 by 762 mm)] [24 by 36 inches (610 by 915 mm)] [32 by 32 inches (815 by 815 mm)] [36 by 36 inches (915 by 915 mm)].
   d. Height: [6 inches (150 mm)] [10 inches (255 mm)] [12 inches (305 mm)] [12 inches (305 mm) with dropped front].
   e. Tiling Flange: [Not required] [On one side] [On two sides] [On three sides].
   f. Rim Guard: On [front] [all] top surfaces.
   g. Color: [Not applicable] <Insert color>.
   h. Drain: Grid with [NPS 2 (DN 50)] [NPS 3 (DN 80)] outlet.

3. Mounting: On floor and flush to wall.

B. Service Basins <Insert drawing designation>: Plastic, floor mounted.

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

   a. Crane Plumbing, L.L.C.
   b. Ferguson Enterprises, Inc.; ProFlo Brand.
   c. Florestone Products Co., Inc.
2. Fixture:
   b. Material: Cast polymer.
   c. Nominal Size: [24 by 36 by 10 inches (610 by 915 mm by 255 mm)] [36 by 36 by 10 inches (915 by 915 by 255 mm)].
   d. Tiling Flange: [Not required] [On one side] [On two sides] [On three sides].
   e. Rim Guard: On [front] [all] top surfaces.
   f. Color: [Not applicable] <Insert color>.
   g. Drain: Grid with [NPS 2 (DN 50)] [NPS 3 (DN 80)] outlet.

3. Mounting: On floor and flush to wall.


2.2 SERVICE SINKS

A. Service Sinks <Insert drawing designation>: Enameled, cast iron, trap standard mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Commercial Enameling Company.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Type: Service sink with back.
   c. Back: [Two faucet holes] [Plain].
   d. Nominal Size: [22 by 18 inches (560 by 457 mm)] [24 by 20 inches (610 by 508 mm)].
   e. Color: White.
   f. Mounting: [NPS 2 (DN 50)] [NPS 3 (DN 80)] P-trap standard with grid strainer inlet, cleanout, and floor flange.
   g. Rim Guard: On front and sides.

3. Faucet: <Insert sink-faucet designation from "Sink Faucets" Article>.

4. Support: ASME A112.6.1M, Type II, sink carrier.

B. Service Sinks <Insert drawing designation>: Vitreous china, trap standard mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Plumbing, L.L.C.
b. Kohler Co.
c. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Type: Service sink with back.
   c. Back: [Two faucet holes] [Plain].
   d. Nominal Size: 22 by 20 inches (560 by 508 mm).
   e. Color: White.
   f. Mounting: [NPS 2 (DN 50)] [NPS 3 (DN 80)] P-trap standard with grid strainer inlet, cleanout, and floor flange.
   g. Rim Guard: On front and sides.

3. Faucet: <Insert sink-faucet designation from "Sink Faucets" Article>.

4. Support: ASME A112.6.1M, Type II, sink carrier.

C. Service Sinks <Insert drawing designation>: Enamelled, cast iron, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Commercial Enameling Company.
   c. Gerber Plumbing Fixtures LLC.
   d. Kohler Co.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
   b. Style: With front apron and raised back.
   c. Nominal Size: 28 by 28 inches (710 by 710 mm).
   e. Drain: Grid with [NPS 2 (DN 50)] [NPS 3 (DN 80)] outlet.
   f. Rim Guard: Coated wire.

3. Faucet: <Insert sink-faucet designation from "Sink Faucets" Article>.

2.3 UTILITY SINKS

A. Utility Sinks <Insert drawing designation>: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Tabco.
   c. Elkay Manufacturing Co.
2. Fixture:
   b. Type: Ledge back.
   c. Number of Compartments: [One] [Two] [Three].
   d. Overall Dimensions: <Insert dimensions>.
   e. Metal Thickness: 0.050 inch (1.3 mm).  
   [Retain "Compartment" Subparagraph below for single-compartment sinks.]
   f. Compartment:
      1) Dimensions: <Insert dimensions>.
      2) Drain: [Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain]  
         [Grid with NPS 2 (DN 50) tailpiece and twist drain]  
         [NPS 1-1/2 (DN 40) tailpiece with stopper].
      3) Drain Location: [Centered in compartment] [Near back of compartment]  
         [Near left side of compartment] [Near right side of compartment].
      [Retain "Each Compartment" Subparagraph below for multiple-compartment sinks.]
   g. Each Compartment:
      1) Dimensions: <Insert dimensions>.
      2) Drains: [Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain]  
         [Grid with NPS 2 (DN 50) tailpiece and twist drain]  
         [NPS 1-1/2 (DN 40) tailpiece with stopper].
      3) Drain Location: [Centered in compartment] [Near back of compartment].

3. Faucet(s): <Insert sink-faucet designation from "Sink Faucets" Article>.
   a. Number Required: [One] [Two].
   b. Mounting: On ledge.

4. Supply Fittings:
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching  
      water-supply piping type and size.
      1) Operation: [Loose key] [Wheel handle].
      2) Risers: NPS 1/2 (DN 15), [chrome-plated, rigid-copper pipe]  
         [chrome-plated, soft-copper flexible tube]  
         [ASME A112.18.6, braided or corrugated stainless-steel flexible hose].

5. Waste Fittings:
b. Trap(s):
   1) Size: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)].
   2) Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall]; and chrome-plated brass or steel wall flange.

c. Continuous Waste:
   1) Size: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)].
   2) Material: Chrome-plated, 0.032-inch- (0.83-mm-) thick brass tube.


B. Utility Sinks <Insert drawing designation>: Stainless steel, freestanding.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Tabco.
   b. AERO Manufacturing Company.
   c. Amtekco Industries, Inc.
   d. Eagle Group; Foodservice Equipment Division.
   e. Elkay Manufacturing Co.
   f. Griffin Products, Inc.
   g. Just Manufacturing.

2. Fixture:
   b. Type: With backsplash.
   c. Number of Compartments: [One] [Two] [Three].
   d. Overall Dimensions: <Insert dimensions>.
   e. Metal Thickness: [0.050 inch (1.3 mm)] [0.063 inch (1.6 mm)].
   [Retain "Compartment" Subparagraph below for single-compartment sinks.]
   f. Compartment:
      1) Dimensions: <Insert dimensions>.
      2) Drain: [Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain] [Grid with NPS 2 (DN 50) tailpiece and twist drain] [NPS 1-1/2 (DN 40) tailpiece with stopper].
      3) Drain Location: [Centered in compartment] [Near back of compartment] [Near left side of compartment] [Near right side of compartment].
   [Retain "Each Compartment" Subparagraph below for multiple-compartment sinks.]
   g. Each Compartment:
      1) Dimensions: <Insert dimensions>. 

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2) Drains: [Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain] [Grid with NPS 2 (DN 50) tailpiece and twist drain] [NPS 1-1/2 (DN 40) tailpiece with stopper].

3) Drain Location: [Centered in compartment] [Near back of compartment].

h. Drainboard(s): [Not required] [Both] [Left] [Right] side(s).

1) Dimensions Each: [Not applicable] <Insert dimensions>.


4. Faucet(s): <Insert sink-faucet designation from "Sink Faucets" Article>.

   a. Number Required: [One] [Two].
   b. Mounting: On backsplash.

5. Supply Fittings:

   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

      1) Operation: [Loose key] [Wheel handle].
      2) Risers: NPS 1/2 (DN 15), [chrome-plated, rigid-copper pipe] [chrome-plated, soft-copper flexible tube] [ASME A112.18.6, braided or corrugated stainless-steel flexible hose].

6. Waste Fittings:

   b. Trap(s):

      1) Size: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)].
      2) Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall]; and chrome-plated brass or steel wall flange.

   c. Continuous Waste:

      1) Size: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)].
      2) Material: Chrome-plated, 0.032-inch- (0.83-mm-) thick brass tube.

2.4 HANDWASH SINKS

A. Handwash Sinks <Insert drawing designation>: Stainless steel, wall mounted.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Advance Tabco.
b. AERO Manufacturing Company.
c. Amtekco Industries, Inc.
d. Eagle Group; Foodservice Equipment Division.
e. Elkay Manufacturing Co.
f. Griffin Products, Inc.
g. Just Manufacturing.

2. Fixture:
   b. Type: Basin with radius corners, back for faucet, and support brackets.
   c. Nominal Size: 17 by 16 by 5 inches (432 by 406 by 127 mm).

3. Faucet: <Insert sink-faucet designation from "Sink Faucets" Article>.


2.5 SACRISTY SINKS

A. Sacristy Sinks <Insert drawing designation>: Stainless steel, two bowl, counter mounted.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing.

   2. Fixture:
      b. Type: Self-rimming.
      d. Nominal Size: Approximately 22 by 42 inches (560 by 1070 mm).
      e. Cover: Hinged with lock on [left] [right] bowl.

3. Faucet: <Insert sink-faucet designation from "Sink Faucets" Article>.

   a. Location: On [left] [right] bowl.


5. Waste Fittings:
   b. [Left] [Right] Bowl:
      1) Drain: Cup with stopper and NPS 1-1/2 (DN 40) tailpiece.
      2) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, tubular-brass direct waste without trap, separate waste piping, and wall flange.
c. Opposite Bowl:

1) Drain: Grid with stopper and NPS 1-1/2 (DN 40) tailpiece.
2) Trap:
   a) Size: NPS 1-1/2 (DN 40).
   b) Material: Comply with requirements in "Waste Fittings" Article.

2.6 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets <Insert drawing designation>: Manual type, [single-control] [two-lever-handle] mixing valve.

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

   [Retain one of two lists of manufacturers below. First list is for commercial, solid-brass faucets.]

   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Elkay Manufacturing Co.
   f. GROHE America, Inc.
   g. Just Manufacturing.
   h. Kohler Co.
   i. Briggs Plumbing Products, Inc.
   j. Ferguson Enterprises, Inc.; ProFlo Brand.
   k. Sterling; a Kohler company.

   [List of manufacturers below is for copper- or brass-underbody faucets.]

   l. Peerless faucets
   m. Price Pfister
   n. Price Pfister
   o. Price Pfister
   p. Price Pfister


3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.

4. Body Type: [Centerset] [Widespread] [Single hole].

5. Body Material: [Commercial, solid brass] [General-duty, solid brass] [Copper or brass underbody].

6. Finish: [Chrome plated] [Polished chrome plate].

7. Maximum Flow Rate: [2.2 gpm (8.3 L/min.)] [4.0 gpm (15 L/min.)].

8. Handle(s): [Lever] [Cross, four arm] [Wrist blade, 4 inches (102 mm)] [Elbow, 6 inches (152 mm)] [Not applicable].

9. Mounting Type: [Deck, concealed] [Deck, exposed] [Back/wall, exposed].

10. Spout Type: [Rigid, solid brass] [Rigid, solid brass with wall brace] [Swing, round tubular] [Swing, shaped tube] [Swing, solid brass] [Rigid gooseneck] [Swivel gooseneck].

12. Spout Outlet: [Aerator] [Laminar flow] [Hose thread according to ASME B1.20.7] [Plain end] [Spray].

2.7 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

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

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.
3. NEOPERL, Inc.

C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.8 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "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] [Wheel handle].

F. Risers:

1. NPS 1/2 (DN 15)
2. [Chrome-plated, rigid-copper pipe] [Chrome-plated, soft-copper flexible tube] [ASME A112.18.6, braided or corrugated stainless-steel flexible hose].

2.9 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:
1. Size: NPS 1-1/2 (DN 40).
2. Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [one-piece, cast-brass trap with swivel 0.029-inch- (73-mm-) thick tubular brass wall bend]; and chrome-plated brass or steel wall flange.

2.10 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before 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, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty 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 Cleveland Clinic.

END OF SECTION 224216.16
SECTION 224223 - COMMERCIAL SHOWERS, RECEPTORS, AND BASINS

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. Individual shower receptors.
2. Shower faucets.
3. Shower basins.
4. Group showers.
5. Outdoor showers.

B. Related Requirements:

1. Section 224300 "Medical Plumbing Fixtures" for healthcare showers.
2. Section 224500 "Emergency Plumbing Fixtures" for emergency showers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers and basins.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1[and Credit WE 3] [, Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

A. Individual FRP Showers <Insert drawing designation>:

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

   a. Clarion Bathware.
   b. Florestone Products Co., Inc.
   c. Kohler.
   d. MAAX; Aker Division.
   e. Praxis Industries, LLC.; Aquarius Bathware.
   f. Sterling; a Kohler company.
   g. Swan Corporation (The).

2. General: FRP [, accessible,] shower enclosure with faucet and receptor[ and appurtenances].
4. Type: [One-piece unit with top] [One-piece unit without top] [Sectional unit with top] [Sectional unit without top].
5. Style: [Standard residential] [Handicapped/wheelchair].
7. Nominal Size and Shape: [30 by 30 inches (762 by 762 mm) square] [32 by 32 inches (813 by 813 mm) square] [34 by 34 inches (864 by 864 mm) square] [36 by 36 inches (915 by 915 mm) square] [48 by 34 to 36 inches (1219 by 864 to 915 mm) rectangular] [60 by 34 to 36 inches (1524 by 864 to 915 mm) rectangular] [36 inches (915 mm) neo-corner (two walls)] [36 inches (915 mm) neo-corner (four walls)] [38 inches (965 mm) neo-corner (two walls)] [38 inches (965 mm) neo-corner (four walls)] [42 inches (1067 mm) neo-corner (two walls)] [42 inches (1067 mm) neo-corner (four walls)].
10. Outlet: Drain with NPS 2 (DN 50) outlet.
11. Shower Rod and Curtain: [Not required] [Required].
12. Grab Bar: [ASTM F 446, mounted on support area back wall] [Not required].

B. Individual PMMA Showers <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acryline USA, Inc.
   b. Aqua Bath Company, Inc.
   c. Aqua Glass Corporation.
   d. Aquatic Industries, Inc.
   e. Clarion Bathware.
   f. Crane Plumbing, L.L.C.
   g. Jacuzzi Inc.
   h. Kohler Co.
   i. LASCO Bathware.
   j. MAAX.
   k. Praxis Industries, LLC.; Aquarius Bathware.

2. General: PMMA shower enclosure with faucet and receptor [and appurtenances].
4. Type: [One-piece unit with top] [One-piece unit without top] [Sectional unit with top] [Sectional unit without top].
5. Style: [Standard residential] [Handicapped/wheelchair].
7. Nominal Size and Shape: [30 by 30 inches (762 by 762 mm) square] [32 by 32 inches (813 by 813 mm) square] [34 by 34 inches (864 by 864 mm) square] [36 by 36 inches (915 by 915 mm) square] [48 by 34 to 36 inches (1219 by 864 to 915 mm) rectangular] [60 by 34 to 36 inches (1524 by 864 to 915 mm) rectangular] [36 inches (915 mm) neo-corner (two walls)] [36 inches (915 mm) neo-corner (four walls)] [38 inches (965 mm) neo-corner (two walls)] [38 inches (965 mm) neo-corner (four walls)] [42 inches (1067 mm) neo-corner (two walls)] [42 inches (1067 mm) neo-corner (four walls)].
10. Outlet: Drain with NPS 2 (DN 50) outlet.
11. Shower Rod and Curtain: [Not required] [Required].
12. Grab Bar: [ASTM F 446, mounted on support area back wall] [Not required].

C. Individual Cabinet Showers <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Mustee, E. L. & Sons, Inc.
   d. Stern-Williams Co., Inc.
   e. Swan Corporation (The).

3. Nominal Size: [30 by 30 inches (762 by 762 mm)] [32 by 32 inches (813 by 813 mm)] [36 by 36 inches (915 by 915 mm)] [36 by 39 inches (915 by 990 mm)] [45 by 39 inches (1145 by 990 mm)].
4. Material: [Steel] [Stainless steel] [Composite] [Plastic], [front] [corner] [front and rear] access.

5. Color: [Not applicable] <Insert color>.

6. Accessibility Options: Grab bar and bench.


8. Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves.


2.2 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets <Insert drawing designation>:

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

   b. Chicago Faucets.
   c. Delta.
   d. Kohler Co.
   e. Moen Incorporated.
   f. Powers; a division of Watts Water Technologies, Inc.
   g. Symmons.
   h. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.

3. Faucet:

   a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
   c. Finish: Polished chrome plate.
   d. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
   e. Mounting: [Concealed] [Exposed].
   f. Operation: Single-handle, [push-pull] [or] [twist or rotate] control.
   g. Anti-scald Device: [Integral with mixing valve] [Separate unit] [Not required].
   h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.


5. Shower Head:

   b. Type: [Ball joint with arm and flange] [Without ball joint, but with arm and flange] [Ball joint and head integral with mounting flange] [Integral with mounting flange].
   c. Shower Head Material: Metallic with chrome-plated finish.
d. Spray Pattern: [Adjustable] [Fixed].

e. Integral Volume Control: [Not required] [Required].

f. Shower-Arm, Flow-Control Fitting: [Not required] [1.5 gpm (5.7 L/min.)] [2.0 gpm (7.6 L/min.)].

g. Temperature Indicator: [Integral with faucet] [Not required].

C. Shower Faucets <Insert drawing designation>:

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

b. Chicago Faucets.
c. Delta.
d. Kohler Co.
e. Moen Incorporated.
f. Powers; a division of Watts Water Technologies, Inc.
g. Symmons.
h. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description: Single-handle, thermostatic mixing valve with hot- and cold-water indicators; check stops; and shower head.

3. Faucet:

a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
c. Finish: Polished chrome plate.
d. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
e. Mounting: [Concealed] [Exposed].
f. Operation: Single-handle, [push-pull] [or] [twist or rotate] control.
g. Antiscald Device: [Integral with mixing valve] [ Separate unit] [Not required].
h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.


5. Shower Head:

b. Type: [Ball joint with arm and flange] [Without ball joint, but with arm and flange] [Ball joint and head integral with mounting flange] [Integral with mounting flange].
c. Shower Head Material: Metallic with chrome-plated finish.
d. Spray Pattern: [Adjustable] [Fixed].
e. Integral Volume Control: [Not required] [Required].
f. Shower-Arm, Flow-Control Fitting: [Not required] [1.5 gpm (5.7 L/min.)] [2.0 gpm (7.6 L/min.)].
g. Temperature Indicator: [Integral with faucet] [Not required].
2.3 SHOWER BASINS

A. Shower Basins <Insert drawing designation>:  [Cast-polymer] [FRP] [PMMA] [Precast-terrazzo] [Solid-surface] shower basin.

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

   [Retain one of five lists below that match base material retained in "Shower Basins" Paragraph above.]  [Retain first list below for cast-polymer shower basins.]

   a. Crane Plumbing, L.L.C.
   b. Florestone Products Co., Inc.

   [Retain first list below for FRP shower basins.]
   c. Crane Plumbing, L.L.C.
   d. Florestone Products Co., Inc.
   e. LASCO Bathware.
   f. MAAX.
   g. MAAX; Aker Division.
   h. Mustee, E. L. & Sons, Inc.
   i. Sterling; a Kohler company.
   j. Swan Corporation (The).

   [Retain first list below for PMMA (acrylic) shower basins.]
   k. American Standard America.
   l. Crane Plumbing, L.L.C.
   m. Florestone Products Co., Inc.
   o. Kohler Co.
   p. LASCO Bathware.
   q. MAAX.
   r. Royal Baths Manufacturing Co.

   [Retain first list below for precast-terrazzo shower basins.]
   s. Acorn Engineering Company.
   t. Crane Plumbing, L.L.C.
   u. Florestone Products Co., Inc.
   v. Stern-Williams Co., Inc.

   [Retain list below for solid-surface shower basins.]
   w. Swan Corporation (The).
   x. Tower Industries.

2. General:  [Cast-polymer] [FRP] [PMMA] [Precast-terrazzo] [Solid-surface] base for built-up-type shower fixture.
5. Standard:  ANSI/ICPA SS-1 for solid-surface material.
6. Type:  [Standard residential] [Handicapped/wheelchair].
7. Nominal Size and Shape:  [30 by 30 inches (762 by 762 mm) square] [32 by 32 inches (813 by 813 mm) square] [36 by 36 inches (915 by 915 mm) square] [42 by 34 to 36 inches (1067 by 864 to 915 mm) rectangular] [48 by 34 to 36 inches (1219 by 864 to 915 mm) rectangular] [36 inches (915 mm) neo-corner] [42 inches (1067 mm) neo-corner].
9. Outlet: Drain with NPS 2 (DN 50) outlet.
10. Bathing Surface: Slip resistant according to ASTM F 462.

2.4 GROUT


B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set [shower receptors] [and] [shower basins] in leveling bed of cement grout.

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 escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in 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. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers [and basins], inspect and repair damaged finishes.

B. Clean showers [and basins], faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers [and basins] for temporary facilities unless approved in writing by Cleveland Clinic.

END OF SECTION 224223
SECTION 224300 - MEDICAL PLUMBING FIXTURES

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 the following healthcare fixtures and specialties:

2. Patient care units.
3. Healthcare showers.
4. Healthcare bathing units.
5. Perineal baths.
7. Bedpan washing equipment.
8. Clinic sinks.
10. Scrub sinks.
11. Hydrotherapy whirlpools.
12. Outlet boxes.

B. Related Requirements:

1. Section 224213.13 "Commercial Water Closets" for conventional water closets, flushometer valves, carriers, and seats for use healthcare facilities, but not requiring special healthcare fixture attributes.
2. Section 224213.16 "Commercial Urinals" for urinals for use in healthcare facilities.
3. Section 224216.13 "Commercial Lavatories" for lavatories for use in healthcare facilities, but not requiring special healthcare fixture attributes.
4. Section 224216.16 "Commercial Sinks" for sinks for use in healthcare facilities, but not requiring special healthcare fixture attributes.
5. Section 224223 "Commercial Showers, Receptors, and Basins" for showers for use in healthcare facilities, but not requiring special healthcare fixture attributes.
6. Section 224500 "Emergency Plumbing Fixtures" for emergency showers and eye-wash units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fixtures.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data: Documentation indicating that flow and water consumption requirements comply with [Prerequisite WE 1] [Prerequisite WE 1 and Credit WE 3] [Prerequisite WE 1, Credit WE 2, and Credit WE 3].

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For plumbing fixtures 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 [flushometer valves] [electronic sensors] [healthcare bathing units] [bedpan washer/sanitizers] [hydrotherapy whirlpools] [and] [morgue equipment].

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
4. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 HEALTHCARE WATER CLOSETS

A. Healthcare Water Closets <Insert drawing designation>: Wall mounted, [top] [back] spud[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated with bedpan lugs or slots.
   g. Water Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size: NPS 1-1/2 (DN 40).


5. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. [Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]
   c. Water-Closet Mounting Height: [Standard] [Child] [Handicapped/elderly according to ICC A117.1].

B. Healthcare Water Closets <Insert drawing designation>: Floor mounted, floor outlet, [top] [back] spud, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. Sloan
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: [Standard] [Handicapped/elderly].
   f. Rim Contour: Elongated with bedpan lugs or slots.
   g. Water Consumption: [1.28 gal. (4.8 L)] [1.6 gal. (6 L)] per flush.
   h. Spud Size: NPS 1-1/2 (DN 40).

C. Healthcare Water Closets <Insert drawing designation>: Floor mounted, back outlet, [top][back] spud[, accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. Sloan.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: [Standard][Handicapped/elderly].
   f. Rim Contour: Elongated with bedpan lugs or slots.
   g. Water Consumption: [1.28 gal. (4.8 L)][1.6 gal. (6 L)] per flush.
   h. Spud Size: NPS 1-1/2 (DN 40).


2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves <Insert designation>.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delta.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.

5. Material: Brass body with corrosion-resistant components.
7. Style: Exposed.
8. Consumption: [1.28 gal. (4.8 L)][1.6 gal. (6 L)] per flush.
2.3 TOILET SEATS

A. Toilet Seats <Insert designation>.
   
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      
      b. Bemis Manufacturing Company.
      c. Church Seats.
      e. Kohler Co.
      f. Olsonite Seat Co.
      g. Zurn Industries, LLC; Commercial Brass and Fixtures.
      
   4. Type: [Commercial (standard)] [Commercial (heavy duty)].
   5. Shape: Elongated rim, open front.
   6. Hinge: Check.

2.4 PATIENT CARE UNITS

A. Patient Care Units <Insert drawing designation>: Factory-fabricated, combination, swing-away water closet and lavatory healthcare plumbing fixture.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      
      b. Metcraft Industries, Inc.
      c. Whitehall Manufacturing; a division of Acorn Engineering Company.
      d. Willoughby Industries.
      
   2. Cabinet: Fixed installation with storage space and toilet paper holder.
      
      a. Material: [Stainless steel] [Stainless steel, plastic laminate, or fiberglass] with [laminated-wood or -plastic] [solid-plastic] [stainless-steel] top surface.
      b. Color: [Not applicable] <Insert color>.
      c. Mounting: Wall bracket.
      
      
      b. Orientation: [Left] [Right] hand.
      c. Seal: For outlet.
      d. Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
e. Toilet Seat: White, solid plastic.
f. Support: Floor plate.

4. Lavatory: Counter mounted.
   a. Material: [Stainless steel] [Cultured marble] [Solid-surface material] <Insert material>.
   b. Color: [Not applicable] <Insert color>.
   c. Faucet: [Gooseneck type with wrist-blade handles] [Swing-spout type with single lever] complying with ASME A112.18.1/CSA B125.1 and NSF 61.
   d. Waste Fittings: Grid drain, with NPS 1-1/4 (DN 32) tailpiece and [NPS 1-1/4 (DN 32)] [NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32)] chrome-plated, cast-brass P-trap; tubular-brass waste to wall; and wall flange complying with ASME A112.18.2/CSA B125.2.

B. Patient Care Units <Insert drawing designation>: Factory-fabricated, combination, fixed-position water closet and lavatory healthcare fixture.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Metcraft Industries, Inc.
   c. Whitehall Manufacturing; a division of Acorn Engineering Company.
   d. Willoughby Industries.

2. Cabinet: Fixed installation; swing-away cabinet or retractable, water-closet cover design with storage space and toilet paper holder.
   a. Material: [Stainless steel] [Stainless steel, plastic laminate, or fiberglass] with [laminated-wood or -plastic] [solid-plastic] [stainless-steel] top surface.
   b. Color: [Not applicable] <Insert color>.
   c. Support: Wall bracket.

   a. Material: Stainless steel or vitreous china.
   b. Orientation: [Left] [Right] hand.
   c. Seal: For outlet.
   d. Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
   e. Toilet Seat: White, solid plastic.

4. Lavatory: Counter mounted.
   a. Material: [Stainless steel] [Cultured marble] [Solid-surface material].
   b. Color: [Not applicable] <Insert color>.
   c. Faucet: [Gooseneck type with wrist-blade handles] [Swing-spout type with single lever] complying with ASME A112.18.1/CSA B125.1 and NSF 61.
   d. Waste Fittings: Grid drain, with NPS 1-1/4 (DN 32) tailpiece and [NPS 1-1/4 (DN 32)] [NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32)] chrome-plated, cast-brass
2.5 HEALTHCARE SHOWERS

A. Healthcare Showers <Insert drawing designation>: Accessible, [glass-fiber-reinforced plastic] [acrylic].

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

[Retain one of two lists of manufacturers below. First list below is for fiber-glass-reinforced plastic showers.]

a. Clarion Bathware.
b. Florestone Products Co., Inc.
c. Kohler.
   [List of manufacturers below is for acrylic showers.]
d. Aqua Bath Company, Inc.
e. Clarion Bathware.
f. Crane Plumbing, L.L.C.


3. Nominal Size: 60 by 36 inches (1524 by 915 mm).

4. Surround: One piece [or sealed, multiple piece].

5. Bathing Surface: Slip resistant according to ASTM F 462.


7. Drain Location: [Left side] [Center] [Right side].

8. Accessibility Options: Include grab bar and bench.


10. Drain: Grid, NPS 2 (DN 50), complying with ASME A112.18.2/CSA B125.2.

2.6 HEALTHCARE SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.


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

b. Chicago Faucets.
c. Delta.
d. Kohler Co.
e. Moen Incorporated.
f. Powers; a division of Watts Water Technologies, Inc.
2. Faucet:
   a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
   c. Finish: Polished chrome plate.
   d. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
   e. Mounting: [Concealed] [Exposed].
   f. Operation: Single-handle, [push-pull] [or] [twist or rotate] control.
   g. Antiscald Device: [Integral with mixing valve] [Separate unit] [Not required].
   h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water-supply connections.
   i. Indicators: For hot and cold water.

3. Shower Head:
   b. Type: [Ball joint with arm and flange] [Without ball joint, but with arm and flange] [Ball joint and head integral with mounting flange] [Integral with mounting flange] [Hand held, slide bar mounted] [Hand held, hook mounted].
   c. Shower Head Material: Metallic with chrome-plated finish.
   d. Spray Pattern: [Adjustable] [Fixed].
   e. Integral Volume Control: [Not required] [Required].
   f. Shower-Arm, Flow-Control Fitting: [Not required] [1.5 gpm (5.7 L/min.)] [2.0 gpm (7.6 L/min.)].
   g. Temperature Indicator: [Integral with faucet] [Not required].

C. Healthcare Shower Faucets <Insert drawing designation>: Thermostatic mixing valve.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Chicago Faucets.
      b. Powers; a division of Watts Water Technologies, Inc.

2. Faucet:
   a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
   c. Finish: Polished chrome plate.
   d. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
   e. Mounting: [Concealed] [Exposed].
   f. Operation: Single-handle, [push-pull] [or] [twist or rotate] control.
   g. Antiscald Device: [Integral with mixing valve] [Separate unit] [Not required]
   h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water-supply connections.
   i. Indicators: For hot and cold water.

3. Shower Head:
b. Type: [Ball joint with arm and flange] [Without ball joint, but with arm and flange] [Ball joint and head integral with mounting flange] [Integral with mounting flange] [Hand held, slide bar mounted] [Hand held, hook mounted].
c. Material: Metallic with chrome-plated finish.
d. Spray Pattern: [Adjustable] [Fixed].
e. Integral Volume Control: [Not required] [Required],
f. Shower-Arm, Flow-Control Fitting: [Not required] [1.5 gpm (5.7 L/min.)] [2.0 gpm (7.6 L/min.)].
g. Temperature Indicator: [Integral with faucet] [Not required].

2.7 HEALTHCARE BATHING UNITS

A. Healthcare Bathing Units <Insert drawing designation>: Side-entry[, whirlpool].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ARJO, Inc.
   b. Invacare Continuing Care Group.

   b. Tub Size: 60 by 30 inches (1524 by 762 mm).
   c. Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.


4. Drain: Manufacturer's standard [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)] with tailpiece.

5. Drain Piping: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)] cast-brass P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2. Include combined drain piping if two drains.

6. Unit Electrical Characteristics:
   a. Volts: [120] [240] [277] [480].
   b. Phase(s): [One] [Three].
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert amperage>.

B. Healthcare Bathing Units <Insert drawing designation>: [Side] [Transfer-lift] [Slide-on] entry, [adjustable] [fixed] height.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ARJO, Inc.
   b. Clarion Bathware.
c. **Invacare Continuing Care Group.**

2. **Fixture:** Plastic-tub, institutional bath fixture with integral controls.
   
   a. **Tub Size:** *60 by 30 inches (1524 by 762 mm).*
   b. **Controls:** Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.

3. **Supply Connections:** 
   
   a. Manufacturer's standard *NPS 3/4 (DN 20)  [NPS 1 (DN 25)]* with shutoff valve.

4. **Drain:**
   
   a. *NPS 1-1/2 (DN 40)  [NPS 2 (DN 50)]* cast-brass P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2. Include combined drain piping if two drains.

5. **Drain Piping:**
   
   a. *NPS 1-1/2 (DN 40)  [NPS 2 (DN 50)]* P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2. Include combined drain piping if two drains.

6. **Lift System:** *Not required*  
   
   a. **Volts:** *120  [240]  [277]  [480].*
   
   b. **Phase(s):** [One] [Three].
   
   c. **Hertz:** 60.
   
   d. **Full-Load Amperes:** *Insert value*. 
   
   e. **Minimum Circuit Ampacity:** *Insert value*. 
   
   f. **Maximum Overcurrent Protection:** *Insert amperage*.

C. **Healthcare Bathing Units**  

   a. Subject to compliance with requirements, provide products by one of the following:
   
   a. **ARJO, Inc.**
   
   b. **Invacare Continuing Care Group.**

2. **Fixture:** Plastic-tub, institutional fixture with integral controls.

   a. **Cabinet Size:** *35 by 41 inches (889 by 1041 mm).*
   
   b. **Controls:** Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.

3. **Supply Connections:** 

4. **Drain:**

5. **Drain Piping:**

6. **Unit Electrical Characteristics:**

   a. **Volts:** *120  [240]  [277]  [480].*
   
   b. **Phase(s):** [One] [Three].
   
   c. **Hertz:** 60.
   
   d. **Full-Load Amperes:** *Insert value*. 
   
   e. **Minimum Circuit Ampacity:** *Insert value*. 
   
   f. **Maximum Overcurrent Protection:** *Insert amperage*. 

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HEALTHCARE PLUMBING FIXTURES 224300 - 10
2.8 PERINEAL BATHS

A. Perineal Baths <Insert drawing designation>: Pedestal mounted, vitreous china.

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

2. Fixture:
   c. Drain: NPS 1-1/2 (DN 40) with tailpiece and removable overflow attachment.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Powers; a division of Watts Water Technologies, Inc.
      2) Symmons Industries, Inc.
   c. Material: Brass body and escutcheon.
   d. Flow Rate: Modified to 1.5 gpm (5.7 L/min.) maximum unless otherwise indicated.
   e. Finish: Polished chrome plate.
   f. Temperature Indicators: Color-coded for hot and cold water.

4. Exposed Piping: Chrome plated; brass pipe or copper tube.
5. Supply Connections: NPS 1/2 (DN 15).

2.9 BEDPAN WASHERS

A. Bedpan Washers <Insert drawing designation>: Wall mounted, compact.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Chicago Faucets.
   c. Kohler Co.
   d. Speakman Company.
   e. T & S Brass and Bronze Works, Inc.
   f. Whitehall Manufacturing; a division of Acorn Engineering Company.
3. Hose Assembly: 48-inch- (1220-mm-) long rubber or vinyl hose with self-closing, hand-held spray nozzle, wall bracket, and hook.
5. Shutoff Valve: Wall-mounted, cross-handle supply stop upstream of vacuum breaker.
7. Finish: Polished chrome-plated finish on exposed metal parts.
8. Supply Connection: NPS 1/2 (DN 15).

B. Bedpan Washers <Insert drawing designation>: Wall-mounted assembly with [floor] [wall]-mounted, [single-pedal] [double-pedal, hot- and cold-water] foot control.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Chicago Faucets.
   c. Kohler Co.T & S Brass and Bronze Works, Inc.
3. Hose: 48-inch- (1220-mm-) long rubber or vinyl hose with self-closing, hand-held spray nozzle, wall bracket, and hook.
5. Shutoff Valve: Wall-mounted, cross-handle supply stop between foot control and vacuum breaker.
7. Finish: Polished chrome-plated finish on exposed metal parts.
8. Control Mounting: [Floor] [Wall].
9. Supply Connection(s): NPS 1/2 (DN 15).

2.10 BEDPAN WASHING EQUIPMENT

A. Bedpan Washers/Sanitizers <Insert drawing designation>: [Recessed] [Wall] mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. STERIS Corporation.
2. Fixture:
   a. Construction: Cast-iron chamber and P-trap waste assembly with spray nozzles and [enameled] [stainless]-steel front panel and cover box.
   b. Controls: Electric, 120-V ac, automatic operation with timer, solenoid valves, and circuit breaker.
   c. Door Mechanism: Foot-pedal operation.
3. Supply Connections: NPS 1 (DN 25) cold water and NPS 3/8 (DN 10) [hot water] [steam].
4. Drain Piping: NPS 3 (DN 80) P-trap and soil pipe.


7. Accessories:
   a. Bedpan Rack(s): [One] [Two].
   b. Urinal Rack(s): [One] [Two].
   c. Drain Tray(s): [One] [Two].

B. Bedpan Washers/Disinfectors <Insert drawing designation>: [Freestanding] [Wall] [Undercounter] mounted.

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

2. Fixture:
   a. Controls: Electric, automatic operation.
   b. Cabinet: Stainless steel.
   c. Wash Chamber: Stainless steel.

3. Supply Connections: NPS 1/2 (DN 15) cold water and NPS 1/2 (DN 15) hot water.

4. Drain Piping: NPS 4 (DN 100) P-trap and soil pipe.


6. Unit Electrical Characteristics:
   a. Volts: [208] [240].
   b. Phase(s): [One] [Three].
   c. Hertz: 60.
   d. Full-Load Amperes: <Insert value>.
   e. Minimum Circuit Ampacity: <Insert value>.
   f. Maximum Overcurrent Protection: <Insert amperage>.

2.11 CLINIC SINKS

A. Clinic Sinks <Insert drawing designation>: Wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture: Back-outlet, vitreous-china, blowout-type, flushing-rim, service sink.

   b. Nominal Size: 25 by 20 inches (635 by 510 mm).
c. Outlet Size: NPS 4 (DN 100) [or NPS 3 (DN 80)].
e. Rim Guard: Stainless steel, on front.


5. Support: ASME A112.61M, Type IV sink carrier.

B. Clinic Sinks <Insert drawing designation>: Floor mounted.

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

   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture: Bottom-outlet, vitreous-china, siphon-jet, flushing-rim, service sink.

   b. Nominal Size: 27 by 20 inches (685 by 510 mm).
   d. Rim Guards: Stainless steel on front.

3. Sink Base: 10 inches (254 mm) high; cast terrazzo if required.


5. Faucet: <Insert sink-faucet designation>.


2.12 PLASTER SINKS

A. Plaster Sinks <Insert drawing designation>: Wall mounted, vitreous china.

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

   b. Crane Plumbing, L.L.C.
   c. Kohler Co.

2. Fixture:

   b. Type: Utility sink.
   c. Nominal Size: [24 by 22 inches (610 by 560 mm)] [30 by 22 inches (762 by 560 mm)] with back.
   e. Faucet Holes: [One] [Two] in back.
f. Drain: Grid, NPS 1-1/2 (DN 40) [with NPS 1-1/2 (DN 40) to NPS 2 (DN 50) adaptor].

3. Faucet: <Insert sink-faucet designation>.
5. Drain Piping: [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)] chrome-plated brass; 0.045-inch (1.1-mm) thick waste to interceptor; interceptor to wall; and wall flange complying with ASME A112.18.2/CSA B125.2.
6. Plaster Interceptor:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Josam Company.
      2) MIFAB, Inc.
      4) Tyler Pipe; Wade Div.
      5) Watts Drainage Products; a division of Watts Water Technologies, Inc.
      6) Zurn Industries, LLC; Specification Drainage Products.
   b. Description: Cast-iron or steel body and removable cover with acid-resistant-enameled interior lining and outside coating; removable, corrosion-resistant metal screens or strainer; and [NPS 1-1/2 (DN 40)] [NPS 2 (DN 50)] inlet and outlet.

7. Support: ASME A112.6.1M, Type III sink carrier with white-enameled-steel brackets.

2.13 SCRUB SINKS

A. Scrub Sinks <Insert drawing designation>: Stainless steel, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CSI Industries Inc.
   b. Elkay Manufacturing Co.
   c. Just Manufacturing.
   d. STERIS Corporation.
   e. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Fixture:
   b. Nominal Size: 31 by 20 inches (790 by 510 mm) with back with one faucet hole.
   c. Drain: Grid, NPS 1-1/2 (DN 40).

3. Faucet: <Insert sink-faucet designation>.
5. Support: ASME A112.6.1M, Type II sink carrier.

B. Scrub Sinks <Insert drawing designation>: Vitreous china, wall mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.

2. Fixture:
   b. Nominal Size: [28 by 22 inches (710 by 560 mm)] [30 by 22 inches (762 by 560 mm)] with back or ledge with one faucet hole.
   d. Drain: Grid, NPS 1-1/2 (DN 40).

3. Faucet: <Insert sink-faucet designation>.
6. Support: ASME A112.6.1M, Type I, Type II, or Type III sink carrier.

2.14 SINK FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets <Insert drawing designation>: Manual-operation mixing valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Elkay Manufacturing Co.
   f. GROHE America, Inc.
   g. Just Manufacturing.
   h. Kohler Co.
   i. Moen Incorporation.
   j. Speakman Company.
   k. T & S Brass and Bronze Works, Inc.
   l. Zurn Industries, LLC; Commercial Brass and Fixtures.

3. Configuration: Hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: [Centerset] [Widespread] [Single hole].
6. Finish: [Chrome plated] [Polished chrome plate].
7. Maximum Flow Rate: [2.2 gpm (8.3 L/min.)] [2.5 gpm (9.5 L/min.).]
[Retain one of two "Control" subparagraphs below.]

8. Control: [Lever] [Cross, four-arm] [Wrist-blade, 4-inch (102-mm)] [Elbow, 6-inch (152-mm)] handle(s).
9. Control: [Foot pedal] [Knee action].
10. Mounting Type: [Deck, concealed] [Deck, exposed] [Back/wall, exposed].
11. Spout Type: [Rigid] [Swivel], [low profile] [gooseneck].
13. Spout Outlet: [Aerator] [Laminar flow] [Hose thread] [Plain end] [Spray].


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Chicago Faucets.
   c. Hydrotek International, Inc.
   d. Kohler Co.
   e. Moen Incorporated.
   f. Sloan Valve Company.
   g. Speakman Company.
   h. T & S Brass and Bronze Works, Inc.
   i. Zurn Industries, LLC; Commercial Brass and Fixtures.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Configuration: Hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: [Centerset] [Widespread] [Single hole].
7. Finish: [Polished chrome plate].
8. Maximum Flow Rate: [2.2 gpm (8.3 L/min.)] [2.5 gpm (9.5 L/min.)] unless otherwise indicated.
9. Mounting Type: [Deck, concealed] [Deck, exposed] [Back/wall, exposed].
10. Spout Type: [Rigid] [Swivel], [low profile] [gooseneck].
12. Spout Outlet: [Laminar flow] [Hose thread] [Plain end] [Spray].

2.15 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

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

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.
3. NEOPERL, Inc.
B. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes faucet flow.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

2.16 HYDROTHERAPY WHIRLPOOLS

A. Hydrotherapy Whirlpools <Insert drawing designation>: Podiatry.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ferno Ille; a division of Ferno-Washington, Inc.
   b. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Description: Stationary stainless-steel tank for feet and ankles.
   c. Controls.
   d. Thermometer: Control panel or tank mounted.
   e. One electric turbine ejector.
   f. Unit Electrical Characteristics:
      1) Volts: [120] [240] [277] [480].
      2) Phase(s): [One] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert amperage>.

B. Hydrotherapy Whirlpools <Insert drawing designation>: Upper extremity.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ferno Ille; a division of Ferno-Washington, Inc.
   b. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Description: Stationary, pedestal-mounted, stainless-steel tank for arms, hands, and elbows.
   c. One arm support.
   d. Controls.
   e. Thermometer: Control panel or tank mounted.
   f. One electric turbine ejector.
g. Unit Electrical Characteristics:
   1) Volts: [120] [240] [277] [480].
   2) Phase(s): [One] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert amperage>.

C. Hydrotherapy Whirlpools <Insert drawing designation>: High tank, body.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ferno Ille; a division of Ferno-Washington, Inc.
      b. Whitehall Manufacturing; a division of Acorn Engineering Company.
   2. Description: Stationary stainless-steel tank for legs, hips, and back.
      c. Controls.
      d. Thermometer: Control panel or tank mounted.
      e. One electric turbine ejector.
      f. Unit Electrical Characteristics:
         1) Volts: [120] [240] [277] [480].
         2) Phases: [One] [Three].
         3) Hertz: 60.
         4) Full-Load Amperes: <Insert value>.
         5) Minimum Circuit Ampacity: <Insert value>.
         6) Maximum Overcurrent Protection: <Insert amperage>.

D. Hydrotherapy Whirlpools <Insert drawing designation>: Low tank, body.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ferno Ille; a division of Ferno-Washington, Inc.
      b. Whitehall Manufacturing; a division of Acorn Engineering Company.
   2. Description: Stationary, extended-length, stainless-steel tank for legs, hips, and lower back.
      c. Controls.
      d. Thermometer: Control panel or tank mounted.
      e. Head rest.
      f. One electric turbine ejector.
      g. Unit Electrical Characteristics:
1) Volts: [120] [240] [277] [480].
2) Phase(s): [One] [Three].
3) Hertz: 60.
4) Full-Load Amperes: <Insert value>.
5) Minimum Circuit Ampacity: <Insert value>.
6) Maximum Overcurrent Protection: <Insert amperage>.

E. Hydrotherapy Whirlpools <Insert drawing designation>: Small Hubbard immersion tank.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ferno Ille; a division of Ferno-Washington, Inc.
   b. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Description: Stationary butterfly-shaped tank for full-body massage.
   a. Tank Dimensions: 93 by 64 by 22 inches (2362 by 1626 by 560 mm).
   b. Overall Height: 34 to 38 inches (864 to 965 mm).
   d. Material: Stainless steel.
   e. Supports: Legs or base.
   f. Controls.
   g. Thermometer: Control panel or tank rim mounted.
   h. Supply: Over-the-rim fill spout.
   i. Drains: Two waste connections.
   j. Electric Turbine Ejectors: Two; one rail mounted on each side.
   k. Thermostatic, mixing-valve assembly.
   l. Unit Electrical Characteristics:
      1) Volts: [120] [240] [277] [480].
      2) Phase(s): [One] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert amperage>.
      m. Hose and hand-held shower.
      n. Wash-out-hose assembly.
      o. Stretcher lift.

F. Hydrotherapy Whirlpools <Insert drawing designation>: Medium Hubbard immersion tank.

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

2. Description: Stationary butterfly-shaped tank for full-body massage.
a. Tank Dimensions: 100 by 73 by 24 inches (2540 by 1854 by 610 mm).
b. Overall Height: 34 to 38 inches (864 to 965 mm).
d. Material: Stainless steel.
e. Supports: Legs or base.
f. Controls.
g. Thermometer: Control panel or tank rim mounted.
h. Supply: Over-the-rim fill spout.
i. Drain: One waste connection.
j. Electric Turbine Ejector: One; panel mounted.
k. Thermostatic, mixing-valve assembly.
l. Unit Electrical Characteristics:
   1) Volts: [120] [240] [277] [480].
   2) Phase(s): [One] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert amperage>.
m. Hose and hand-held shower.
n. Wash-out-hose assembly.
o. Stretcher lift.

G. Hydrotherapy Whirlpools <Insert drawing designation>: Large Hubbard immersion tank.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ferno Ille; a division of Ferno-Washington, Inc.
   b. Whitehall Manufacturing; a division of Acorn Engineering Company.
   2. Description: Stationary butterfly-shaped tank for full-body massage.
     a. Tank Dimensions: 106 by 77 by 22 inches (2692 by 1956 by 560 mm).
     b. Overall Height: 34 inches (864 mm).
     d. Material: Stainless steel.
     e. Supports: Legs or base.
     f. Controls.
     g. Thermometer: Control panel or tank rim mounted.
     h. Supply: Over-the-rim fill spout.
     i. Drain(s): One or two waste connections.
     j. Electric Turbine Ejectors: Two; one rail mounted on each side.
     k. Thermostatic mixing-valve assembly.
     l. Unit Electrical Characteristics:
        1) Volts: [120] [240] [277] [480].
        2) Phase(s): [One] [Three].
        3) Hertz: 60.
4) Full-Load Amperes: <Insert value>.
5) Minimum Circuit Ampacity: <Insert value>.
6) Maximum Overcurrent Protection: <Insert amperage>.

m. Hose and hand-held shower.

n. Wash-out-hose assembly.
o. Stretcher lift.

H. Hydrotherapy Whirlpools <Insert drawing designation>: Full-body immersion tank.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ARJO, Inc.
b. Ferno Ille; a division of Ferno-Washington, Inc.
c. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Description: Stationary rectangular tank for full-body massage.

a. Tank Dimensions: [90 by 32 by 19 inches (2286 by 813 by 483 mm)] [95 by 41 by 22 inches (2413 by 1041 by 560 mm)].
b. Overall Height: 32 or 34 inches (813 or 860 mm).
c. Water Capacity: [195 gal. (738 L)] [260 gal. (984 L)].
d. Material: Stainless steel.
e. Supports: Legs or base.
f. Controls.
g. Thermometer: Control panel or tank rim mounted.
h. Supply: Over-the-rim fill spout.
i. Drain(s): One or two waste connections.
j. Electric Turbine Ejector: One, tank mounted [at end] [on rail] [on side].
k. Thermostatic mixing-valve assembly.
l. Unit Electrical Characteristics:

1) Volts: [120] [240] [277] [480].
2) Phase(s): [One] [Three].
3) Hertz: 60.
4) Full-Load Amperes: <Insert value>.
5) Minimum Circuit Ampacity: <Insert value>.
6) Maximum Overcurrent Protection: <Insert amperage>.

m. Hose and hand-held shower.

n. Wash-out-hose assembly.
o. Stretcher lift.

2.17 OUTLET BOXES

A. Outlet Boxes <Insert drawing designation>: For dialysis equipment.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

b. Bradley Corporation.
c. Metcraft Industries, Inc.
d. Whitehall Manufacturing; a division of Acorn Engineering Company.

2. Description: Recessed-mounted outlet box with water-supply and drain connections.

a. Box and Faceplate: Stainless steel.
b. Supply Fitting(s): [One] [Two] NPS 1/2 (DN 15) PVC ball valve(s) and adapter with male hose-thread outlet.
c. Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.


2.18 MORGUE EQUIPMENT

A. Autopsy Table <Insert drawing designation>:

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

a. CSI Industries Inc.
b. LEEC International, Inc.

2. Description: Pedestal stainless-steel table with sink; designed for downdraft ventilation.

b. Nominal Size: 88 by 30 inches (2250 by 762 mm) with deck faucet holes.
c. Faucet: Manufacturer's standard, deck mounted with wrist- or elbow-blade handles.
d. Aspirator: Deck mounted.
e. Removable body supports.
f. Rinse Assembly: Deck-mounted faucet with hose.
g. Disposer: [Not required] [Required, according to UL 430].
h. Receptacle: Duplex, hospital grade with ground-fault interruption.
i. Supplies: With atmospheric vacuum breakers, according to ASSE 1001, and stops.
j. Drain: Grid with NPS 1-1/2 (DN 40) tailpiece.
k. Waste piping.
l. Unit Electrical Characteristics:

   1) Volts: [120] [240] [277] [480].
   2) Phase(s): [One] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
B. Dissecting Sink <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CSI Industries Inc.
   b. LEEC International, Inc.

2. Description: Wall-mounted sink with backsplash.
   b. Nominal Size: 84 by 28 inches (2130 by 710 mm) with back faucet holes.
   c. Nominal Size: Approximately 30 inches (760 mm) wide.
   d. Equipment drawer.
   e. Faucet: <Insert faucet designation>.
   f. Aspirator: Back mounted.
   g. Rinse Assembly: One back-mounted faucet with hose.
   h. Disposer: [Not required] [Required, according to UL 430].
   i. Support: ASME A112.6.1M, Type I or Type III sink carrier.
   j. Supplies: With atmospheric vacuum breakers, according to ASSE 1001, and stops.
   k. Drain: Grid with NPS 1-1/2 (DN 40) tailpiece.
   l. Waste Piping: Comply with requirements in "Waste Fittings" Article.
   m. Back-mounted, hand-held-type eye wash.
   n. Unit Electrical Characteristics:
      1) Volts: [120] [240] [277] [480].
      2) Phase(s): [One] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert amperage>.

2.19 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61, "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] [Wheel handle].
F. Risers: NPS 1/2 (DN 15) [chrome-plated, rigid-copper pipe and brass straight or offset tailpieces] [chrome-plated, soft-copper flexible tube] [ASME A112.18.6, braided or corrugated stainless-steel, flexible hose].

2.20 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid with NPS 1-1/2 DN 40 tailpiece.

C. Trap:
   1. Size: NPS 1-1/2 (DN 40).
   2. Material: Chrome-plated, [two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall] [one-piece, cast-brass trap with swivel 0.029-inch- (73-mm-) thick tubular brass wall bend]; and chrome-plated brass or steel wall flange.

2.21 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install healthcare plumbing fixtures level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted fixtures.
1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install floor-mounted healthcare water closets on bowl-to-drain, connecting fitting attachments to piping or building substrate.

D. Install counter-mounted fixtures in and attached to casework.

E. Install water-supply piping with stop on each supply to each fixture to be connected to water-distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

   1. Exception: Use ball, gate, or globe valve if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install flushometer valves on healthcare water closets.

G. Install flushometer valves for accessible healthcare water closets, with lever handle mounted on wide side of compartment.

H. Install toilet seats on healthcare water closets.

I. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts, if faucets are not available with required rates and patterns. Include adapters if required.

J. Install laminar-flow, faucet-spout fittings in faucet spouts where laminar-flow fittings are specified.

K. Install shower flow-control fittings with specified maximum flow rates in shower arms.

L. Install traps on fixture outlets.

   1. Exception: Omit trap on fixtures with integral traps.

M. Set healthcare showers in leveling bed of cement grout.

N. 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."

O. Seal joints between healthcare plumbing fixtures, 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."

P. 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."
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 requirements for water piping specified in Section 221116 "Domestic Water Piping."

C. Comply with requirements for soil and waste drainage piping[ and vent piping] specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Comply with requirements for atmospheric vent piping specified in Section 221316 "Sanitary Waste and Vent Piping."

E. 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."

3.4 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning healthcare plumbing fixtures, fittings, and controls.

B. Adjust water pressure at [faucets] [and] [flushometer valves] to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After installing healthcare plumbing fixtures, inspect and repair damaged finishes.

B. Clean healthcare plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of healthcare plumbing fixtures for temporary facilities unless approved in writing by Cleveland Clinic.

END OF SECTION 224300
SECTION 224500 - EMERGENCY PLUMBING FIXTURES

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. Emergency showers.
2. Eyewash equipment.
3. Eye/face wash equipment.
4. Combination units.
5. Supplemental equipment.
6. Water-tempering equipment.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.


D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

B. Field quality-control test reports.
1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.7 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. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.


PART 2 - PRODUCTS

2.1 EMERGENCY SHOWERS

A. Freestanding, Plumbed Emergency Showers, <Insert drawing designation>:

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

2. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.

3. Supply Piping: [NPS 1 (DN 25)] [NPS 1-1/4 (DN 32)] [galvanized steel] [chrome-plated brass or stainless steel] [PVC] with flow regulator and stay-open control valve.


5. Shower Head: 8-inch- (200-mm-) minimum diameter, [chrome-plated brass, stainless steel, or plastic].

B. Off-Floor, Plumbed Emergency Showers, <Insert drawing designation>:

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

2. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1 (DN 25) [galvanized steel] [chrome-plated brass or stainless steel] [PVC] with flow regulator and stay-open control valve.
5. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass, stainless steel, or plastic.
6. Mounting: [Horizontal from wall] [Vertical from ceiling] and supported from piping.

C. Freeze-Protected, Plumbed Emergency Showers, <Insert drawing designation>:

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

2. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
5. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass, stainless steel, or plastic.
6. Heating System: [120] [240]-V ac electric, and insulation with protective jacket.

2.2 EYEWASH EQUIPMENT

A. Standard, Freestanding, Plumbed Eyewash Units, <Insert drawing designation>:

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

2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two receptor-mounted spray heads.
6. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
7. Drain Piping: [NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2] [Include galvanized-steel indirect connection to drainage system].

B. Accessible, Freestanding, Plumbed Eyewash Units, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two receptor-mounted spray heads.
6. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
7. Drain Piping: [NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2] [Include galvanized-steel indirect connection to drainage system].

C. Standard, Wall-Mounted, Plumbed Eyewash Units, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two receptor-mounted spray heads.
6. Receptor: Chrome-plated brass or stainless-steel bowl.
7. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.

D. Accessible, Wall-Mounted, Plumbed Eyewash Units, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two receptor-mounted spray heads.
6. Receptor: [Chrome-plated brass or stainless-steel] bowl.
7. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.

E. Sink, Fixed-Position, Plumbed Eyewash Unit, <Insert drawing designation>:

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

2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two spray heads positioned over sink.
6. Mounting: Attached to sink receptor.

F. Sink, Swivel-Type, Plumbed Eyewash Unit, <Insert drawing designation>:

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

2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
4. Control-Valve Actuator: Movement of spray-head assembly to position over sink.
5. Spray-Head Assembly: Two spray heads with offset piping.
6. Mounting: Deck next to sink.

G. Portable, Self-Contained Eyewash Units, <Insert drawing designation>:

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

2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Pressure Tank: 10 gal. (38 L), stainless steel, cylindrical, with pressure gage, and suitable for on-floor installation.
4. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
5. Spray-Head Assembly: Chrome-plated copper alloy or stainless-steel piping with flow regulator; paddle-actuated, stay-open control valve; and two spray heads mounted on tank.
6. Drench Hose: Hand-held spray head with squeeze-handle actuation and hose attached to tank.

H. Standard, Self-Contained Eyewash Units, <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
4. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
5. Actuator: Pull-down front panel.

I. Freeze-Protected, Self-Contained Eyewash Units, <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
3. Gravity Tank: [14 gal. (53 L) minimum] [20 gal. (76 L) minimum], plastic, and suitable for shelf mounting.
4. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
5. Actuator: Pull-down front panel.
7. Heating System: Electric, 120-V ac; and insulation with protective jacket.

2.3 EYE/FACE WASH EQUIPMENT

A. Standard, Freestanding, Plumbed, Eye/Face Wash Units, <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. **Haws Corporation**.

2. Capacity: Not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
6. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
7. Drain Piping: [NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2] [Include galvanized-steel indirect connection to drainage system].

**B. Accessible, Freestanding, Plumbed, Eye/Face Wash Units, <Insert drawing designation>:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **Bradley Corporation**.
   b. **Haws Corporation**.

2. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
6. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
7. Drain Piping: [NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2] [Include galvanized-steel indirect connection to drainage system].

**C. Standard, Wall-Mounted, Plumbed, Eye/Face Wash Units, <Insert drawing designation>:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **Bradley Corporation**.
   b. **Haws Corporation**.

2. Capacity: Not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
6. Receptor: Chrome-plated brass or stainless-steel bowl.
7. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.
D. Accessible, Wall-Mounted, Plumbed, Eye/Face Wash Units, <Insert drawing designation>:

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

   2. Capacity: Not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
   3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
   5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
   6. Receptor: Chrome-plated brass or stainless-steel bowl.

E. Sink, Fixed-Position, Plumbed, Eye/Face Wash Unit, <Insert drawing designation>:

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

   2. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
   3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
   5. Spray-Head Assembly: Two or four spray heads positioned over sink.
   6. Receptor: Chrome-plated brass or stainless-steel bowl.
   7. Mounting: Attached to sink receptor.

2.4 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units, <Insert drawing designation>:

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

   2. Piping:
      a. Material: [Galvanized steel] [Chrome-plated brass or stainless steel] [PVC].
      b. Unit Supply: [NPS 1-1/4 (DN 32) minimum] [NPS 1-1/2 (DN 40)].
      c. Unit Drain: Outlet at back or side near bottom.
3. **Shower:**
   a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
   c. Control-Valve Actuator: Pull rod.
   d. Shower Head: 8-inch- (200-mm-) minimum diameter, [chrome-plated brass or stainless steel] [plastic].
   e. Mounting: Pedestal.

4. **Eyewash Unit:**
   a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
   b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
   d. Spray-Head Assembly: Two receptor-mounted spray heads.
   e. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
   f. Mounting: Attached shower pedestal.
   
   [Retain subparagraph below if a drench hose is permitted in place of the eyewash unit.]
   g. Drench-Hose Option: May be provided instead of eyewash unit.
      1) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
      2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
      3) Mounting: Bracket on shower pedestal.

B. **Accessible, Plumbed Emergency Shower with Eyewash Combination Units,** <Insert drawing designation>:

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

2. Piping:
   a. Material: [Galvanized steel] [Chrome-plated brass or stainless steel] [PVC].
   b. Unit Supply: [NPS 1-1/4 (DN 32) minimum] [NPS 1-1/2 (DN 40)].
   c. Unit Drain: Outlet at back or side near bottom.

3. **Shower:**
   a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
   c. Control-Valve Actuator: Pull rod.
   d. Shower Head: 8-inch- (200-mm-) minimum diameter, [chrome-plated brass or stainless steel] [plastic].
   e. Mounting: Pedestal.

4. **Eyewash Unit:**
a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
d. Spray-Head Assembly: Two receptor-mounted spray heads.
e. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
f. Mounting: Attached shower pedestal.

[Retain subparagraph below if a drench hose is permitted in place of the eyewash unit.]
g. Drench-Hose Option: May be provided instead of eyewash unit.

1) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
3) Mounting: Bracket on shower pedestal.

C. Standard, Plumbed Emergency Shower with Eye/Face Wash Combination Units, <Insert drawing designation>:

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

2. Piping:
   a. Material: [Galvanized steel] [Chrome-plated brass or stainless steel] [PVC].
   b. Unit Supply: [NPS 1-1/4 (DN 32) minimum] [NPS 1-1/2 (DN 40)].
   c. Unit Drain: Outlet at back or side near bottom.

3. Shower:
   a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
   c. Control-Valve Actuator: Pull rod.
   d. Shower Head: 8-inch- (200-mm-) minimum diameter, [chrome-plated brass or stainless steel] [plastic].
   e. Mounting: Pedestal.

4. Eye/Face Wash Unit:
   a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
   b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
   d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
   e. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
   f. Mounting: Attached shower pedestal.

[Retain subparagraph below if a drench hose is permitted in place of the eye/face wash unit.]
g. Drench-Hose Option: May be provided instead of eye/face wash unit.

1) Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
D. Accessible, Plumbed Emergency Shower with Eye/Face Wash Combination Units, <Insert drawing designation>:

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

2. Piping:
   a. Material: [Galvanized steel] [Chrome-plated brass or stainless steel] [PVC].
   b. Unit Supply: [NPS 1-1/4 (DN 32) minimum] [NPS 1-1/2 (DN 40)].
   c. Unit Drain: Outlet at back or side near bottom.

3. Shower:
   a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
   c. Control-Valve Actuator: Pull rod.
   d. Shower Head: 8-inch- (200-mm-) minimum diameter, [chrome-plated brass or stainless steel] [plastic].
   e. Mounting: Pedestal.

4. Eye/Face Wash Unit:
   a. Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
   b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
   d. Spray-Head Assembly: Two or four receptor-mounted spray heads.
   e. Receptor: [Chrome-plated brass or stainless-steel] [Plastic] bowl.
   f. Mounting: Attached to shower pedestal.
   [Retain subparagraph below if a drench hose is permitted in place of the eye/face wash unit.]
   g. Drench-Hose Option: May be provided instead of eye/face wash unit.

2) Capacity: Not less than 3 gpm (11.4 L/min.) for at least 15 minutes.
3) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
3) Mounting: Bracket on shower pedestal.
2. Capacity: Not less than 0.4 gpm (1.5 L/min).
3. Pressure Tank: 5 gal. (19 L), stainless steel, cylindrical, with pressure gage and base suitable for on-floor installation.
4. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
5. Spray-Head Assembly: Chrome-plated copper alloy or stainless-steel piping with flow regulator; paddle-actuated, stay-open control valve; and two spray heads mounted on tank.

B. Deck-Mounted, Plumbed Drench Hoses, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 0.4 gpm (1.5 L/min).
4. Drench Hose: Hand-held spray head with squeeze-handle actuation and hose.
5. Mounting: In hole in deck.

C. Wall-Mounted, Plumbed Drench Hoses, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Haws Corporation.
2. Capacity: Not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
4. Drench Hose: Hand-held spray head with squeeze-handle actuation and hose.
5. Mounting: Wall bracket.

2.6 WATER-TEMPERING EQUIPMENT
A. Hot- and Cold-Water, Water-Tempering Equipment, <Insert drawing designation>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lawler Manufacturing Co., Inc.
   b. Leonard Valve Company.
   c. Powers; a division of Watts Water Technologies, Inc.
2. Description: Factory-fabricated equipment with thermostatic mixing valve.
a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

b. Supply Connections: For hot and cold water.

2.7 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

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

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

[Retain one or both "Exception" subparagraphs below if applicable.]

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.

2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping. Comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping."
F. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."

G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

[Retain first paragraph below if emergency equipment has a direct connection drain.]

H. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

[Retain first paragraph below if emergency equipment has an indirect waste connection.]

I. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

J. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

K. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."

C. Connect steam and cold-water-supply and condensate return piping to steam and cold water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping" and comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping."

D. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

E. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."
F. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

G. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500
SECTION 224600 - SECURITY PLUMBING FIXTURES

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. Combination units.
   2. Water closets.
   3. Urinals.
   4. Lavatories.
   5. Drinking fountains.
   7. Service sinks.

B. Related Requirements:
   1. Section 224213.13 "Commercial Water Closets."
   2. Section 224213.16 "Commercial Urinals."
   3. Section 224216.13 "Commercial Lavatories."
   4. Section 224216.16 "Commercial Sinks."
   5. Section 224223 "Commercial Showers, Receptors, and Basins."
   6. Section 224300 "Healthcare Plumbing Fixtures."
   7. Section 224500 "Emergency Plumbing Fixtures" for emergency showers.

1.3 DEFINITIONS

A. Accessible Service Space: Service area in secure space behind wall-mounted fixtures.

B. Back-Access Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall or on wall, so installation and removal of fixture, piping, and other components are accessible only from service space behind wall.

C. Front-Access Fixture: Security plumbing fixture designed to mount on wall with installation and removal from fixture side of wall, and with piping and other components accessible only from access panel in fixture.
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 security plumbing fixtures.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. LEED Submittals:
   1. Product Data for Prerequisite WE 1\[ and Credit WE 3\] \[, Credit WE 2, and Credit WE 3\]: Documentation indicating flow and water consumption requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For security plumbing fixtures and components to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Flushometer-Valve Repair Kits: Equal to 10 percent of quantity of each type installed, but no fewer than \[one\] \[six\] of each type.
   2. Toilet Seats: Equal to five percent of quantity of each type installed.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Combination Units <Insert drawing designation>: Back access, \[off\] \[on\] floor, cabinet, with water closet and lavatory.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Bradley Corporation.
      c. Metcraft Industries Inc.
      d. Willoughby Industries, Inc.
   2. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   3. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
4. Cabinet: [Rectangular apron] [Five-sided apron with two angled sides] [Four-sided apron with angled left side] [Four-sided apron with angled right side], with backsplash.
   a. Water-Closet Bowl Location: [Centered on front] [Left of center on front] [Right of center on front] [On angled left side] [On angled right side] of apron.
   b. Toilet-Paper Holder: Recessed; stainless steel located [above water closet and centered in front] [in front] [right of center in front] [left of center in front] [in angled right side] [in angled left side] [in right side] [in left side] of apron.

5. Accessories:
   a. Toothbrush Holders: One on [each] [left] [right] side of backsplash.
   b. Towel Hooks: [One] [Two] on [each] [left] [right] side of fixture.
   c. Bubbler: On [backsplash] [deck].

6. Mounting: Bolts through wall sleeve into accessible service space.
7. Water Closet:
   b. Bowl:
      1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
      2) Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.
      3) Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], horizontal with cleanout and slip joint.

9. Lavatory:
   b. Location: In top of cabinet.
   c. Receptor: [Oval] [or] [rectangular] bowl with integral soap depression.
   d. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
   e. Filler Spout: [Backsplash] [or] [deck] mounted.
   f. Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum waste and trap complying with ASME A112.18.2/CSA B125.2.

10. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.

B. Combination Units <Insert drawing designation>: Front access, on floor, cabinet, with water closet and lavatory.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. Bradley Corporation.
c. Metcraft Industries Inc.
d. Willoughby Industries, Inc.

2. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.

3. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.

4. Cabinet: [Rectangular apron] [Five-sided apron with two angled sides] [Four-sided apron with angled left side] [Four-sided apron with angled right side], with backsplash and access panel.
   a. Water-Closet Bowl Location: [Centered on front] [Left of center on front] [Right of center on front] [On angled left side] [On angled right side] of apron.
   b. Toilet-Paper Holder: Recessed; stainless steel located [above water closet and centered in front] [in front] [right of center in front] [left of center in front] [in angled right side] [in angled left side] [in right side] [in left side] of apron.

5. Accessories:
   a. Toothbrush Holders: One on [each] [left] [right] side of backsplash.
   b. Towel Hooks: [One] [Two] on [each] [left] [right] side of fixture.
   c. Bubbler: On [backsplash] [deck].

6. Mounting: Bolts through wall sleeve into accessible service space.

7. Water Closet:
   b. Bowl:
      1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
      2) Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.
      3) Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], horizontal with cleanout and slip joint.


9. Lavatory:
   b. Location: In top of cabinet.
   c. Receptor: [Oval] [or] [rectangular] bowl with integral soap depression.
   d. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
   e. Filler Spout: [Backsplash] [or] [deck] mounted.
   f. Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum waste and trap complying with ASME A112.18.2/CSA B125.2.

10. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
2.2 STAINLESS-STEEL WATER CLOSETS

A. Water Closets <Insert drawing designation>: Back access, [on] [off] floor, [back] [floor] outlet, cabinet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Metcraft Industries Inc.
   c. Willoughby Industries, Inc.

2. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.

3. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.

4. Cabinet: [Rectangular apron] [Five-sided apron with two angled sides] [Four-sided apron with angled left side] [Four-sided apron with angled right side], with backsplash.

   a. Water-Closet Bowl Location: [Centered on front] [Left of center on front] [Right of center on front] [On angled left side] [On angled right side] of apron.

   b. Toilet-Paper Holder: Recessed; stainless steel located [above water closet and centered in front] [in front] [right of center in front] [left of center in front] [in angled right side] [in angled left side] [in right side] [in left side] of apron.

5. Mounting: Bolts through wall sleeve into accessible service space.

6. Water Closet:

   b. Bowl:
      [Retain one of two "Type" subparagraphs below. First subparagraph is for back-outlet water closets.]

   1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.

   [Retain "Type" Subparagraph below for bottom-outlet water closets. Outlet piping at floor may be visible for off-floor water closets.]

   2) Type: Elongated, with back inlet, integral trap, and siphon-jet design with bottom outlet and contoured seat.

   [Retain "Back-Outlet Connection" or "Bottom-Outlet Connection" Subparagraph below.]

   3) Back-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], horizontal with cleanout and slip joint.

   4) Bottom-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], vertical.

   5) Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.

7. Flushometer Valve: <Insert designation>.

8. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.

B. Water Closets <Insert drawing designation>: Back access, off floor, back outlet, compact.

1. Manufacturers: Subject to compliance with requirements;:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.

3. Material: 0.078-inch- (2.0-mm)- () minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
4. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
5. Bowl:
   a. Type: Elongated, with back inlet, integral trap, and blowout design with contoured seat.
   b. Length to Wall: Approximately 19 inches (483 mm).
   c. Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.

6. Mounting: Bolts through wall sleeve into accessible service space.
7. Flushometer Valve: <Insert designation>.
8. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
   a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.

C. Water Closets <Insert drawing designation>: Back access, [off] [on] floor, [back] [floor] outlet, extended bowl.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.

3. Material: 0.078-inch- (2.0-mm)- () minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
4. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
5. Bowl:
   [Retain one of two "Type" subparagraphs below. First subparagraph is for back-outlet water closets.]
a. Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.

[Retain "Type" Subparagraph below for bottom-outlet water closets. Outlet piping at floor may be visible for off-floor water closets.]
b. Type: Elongated, with back inlet, integral trap, and siphon-jet design with bottom outlet and contoured seat.

c. Length to Wall: Minimum of 25 inches (635 mm).

[Retain "Back-Outlet Connection" or "Bottom-Outlet Connection" Subparagraph below.]
d. Back-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], horizontal with cleanout and slip joint.

e. Bottom-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], vertical.

f. Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.

6. Mounting: Bolts through wall sleeve into accessible pipe space.
7. Flushometer Valve: <Insert designation>.
8. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.

a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.

D. Water Closets <Insert drawing designation>: Front access, [off] [on] floor, [back] [floor] outlet, extended bowl.

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

   b. Metcraft Industries Inc.
   c. Willoughby Industries, Inc.

3. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
4. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
5. Bowl: [Retain one of two "Type" subparagraphs below. First subparagraph is for back-outlet water closets.]

   a. Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet, contoured seat, and access panel.

   [Retain "Type" Subparagraph below for bottom-outlet water closets. Outlet piping at floor may be visible for off-floor water closets.]

   b. Type: Elongated, with back inlet, integral trap, and siphon-jet design with bottom outlet, contoured seat, and access panel.

   c. Length to Wall: Minimum of 25 inches (635 mm).
   d. [Retain "Back-Outlet Connection" or "Bottom-Outlet Connection" Subparagraph below.]
e. Back-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], horizontal with cleanout and slip joint.
f. Bottom-Outlet Connection: [NPS 3 (DN 80)] [NPS 4 (DN 100)], vertical.
g. Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.

6. Mounting: Bolts from fixture-mounted flanges into wall.
7. Flushometer Valve: <Insert designation>.
8. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.

2.3 VITREOUS-CHINA WATER CLOSETS

A. Water Closets <Insert drawing designation>: Floor mounted, back outlet, blowout.

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

2. Fixture:
   b. Bowl: Elongated, vitreous china, with integral trap and contoured seat.
   c. Spud Location and Size: Back, NPS 1-1/2 (DN 40).

3. Flushometer Valve: <Insert designation>.
4. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware match fixture. [Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]

B. Water Closets <Insert drawing designation>: Floor mounted, back outlet, siphon jet.

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

2. Fixture:
   b. Bowl: Elongated, vitreous china, with integral trap and contoured seat.
   c. Spud Location and Size: Top, NPS 1-1/2 (DN 40).

3. Flushometer Valve: <Insert designation>.
4. Support:
a. Standard: ASME A112.6.1M.
b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware match fixture.[Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]

C. Water Closets <Insert drawing designation>: Wall mounted, back outlet, blowout.

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

2. Fixture:
   b. Bowl: Elongated, vitreous china, with integral trap and contoured seat.
   c. Spud Location and Size: Back, NPS 1-1/2 (DN 40).

3. Flushometer Valve: <Insert designation>.

4. Support:
   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware match fixture.[Include additional extension coupling, faceplate, and feet for installation in wide pipe space.]
   c. Water-Closet Mounting Height: [Standard] [Handicapped/elderly according to ICC A117.1].

2.4 FLUSHOMETER VALVES

A. Flushometer Valves <Insert designation>: [Lever handle] [Push button], diaphragm.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Delany Flush Valves.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.

5. Material: Brass body with corrosion-resistant components.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: [Concealed] [Exposed].
9. Consumption:  
   - [1.6 gal. (6 L)]
   - [1.5 gal. (5.7 L)]
   - [1.0 gal. (3.8 L)]
   - [0.5 gal. (1.9 L)]
   per flush.


2.5 URINALS

A. Urinals <Insert drawing designation>: Back access, back outlet, single.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Bradley Corporation.
      c. Metcraft Industries Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: [Blowout] [Washout], with [back] [top] inlet.
   e. Drain: Strainer with NPS 2 (DN 50) tailpiece and trap.

3. Mounting: Bolts through wall sleeve into accessible service space.
5. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.

B. Urinals <Insert drawing designation>: Front access, back outlet, single.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Metcraft Industries Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: [Blowout] [Washout], with [back] [top] inlet and access panel.
   e. Drain: Strainer with NPS 2 (DN 50) tailpiece and trap.

3. Mounting: Bolts from fixture-mounted flanges into wall.
5. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.
C. Urinals <Insert drawing designation>: Back access, back outlet, trough.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Metcraft Industries Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Washout, with [back] [top] inlet, and [36 inches (915 mm)] [48 inches (1220 mm)] [60 inches (1524 mm)] [72 inches (1829 mm)] [96 inches (2438 mm)] wide.
   e. Drain: Strainer with NPS 2 (DN 50) tailpiece and trap.

3. Mounting: Bolts through wall sleeve into accessible service space.
5. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.

D. Urinals <Insert drawing designation>: Bottom outlet, stall.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Washout, with [back] [top] inlet.
   e. Drain: Strainer with NPS 2 (DN 50) outlet.

3. Mounting: Bolts through wall into accessible service space.

2.6 STAINLESS-STEEL LAVATORIES

A. Lavatories <Insert drawing designation>: Back access.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Receptor: [Oval] [or] [rectangular] bowl with integral soap depression and backsplash.
   e. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation, individual check stops, and [backsplash-] [or] [deck-] mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
   f. Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2/CSA B125.2.

3. Accessories:
   a. Toothbrush Holders: One on [each] [left] [right] side of backsplash.
   b. Towel Hooks: [One] [Two] on [each] [left] [right] side of fixture.
   c. Bubbler Location: On [backsplash] [deck].

4. Mounting: Bolts through wall into accessible service space.

B. Lavatories <Insert drawing designation>: Front access.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Receptor: [Oval] [or] [rectangular] bowl with integral soap depression, backsplash, and access panel.
   e. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation, individual check stops, and [backsplash-] [or] [deck-] mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
   f. Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2/CSA B125.2.
3. **Accessories:**
   
a. **Toothbrush Holders:** One on [each] [left] [right] side of backsplash.
b. **Towel Hooks:** [One] [Two] on [each] [left] [right] side of fixture.
c. **Bubbler Location:** On [backsplash] [deck].

4. **Mounting:** Bolts from fixture-mounted flanges into wall.

### 2.7 VITREOUS-CHINA LAVATORIES

**A. Lavatories**<Insert drawing designation>: Wall mounted.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
a. [American Standard American](#)
b. [Crane Plumbing, L.L.C.](#)
c. [Kohler Co.](#)

2. **Fixture:**
   
a. **Standard:** ASME A112.19.2/CSA B45.1.
b. **Material:** Vitreous china.
c. **Receptor:** Oval or rectangular bowl with integral soap depression and wall bracket.
d. **Hot- and Cold-Water Supply Valves:** Factory-installed, with push-button, self-closing, chrome-plated brass faucets complying with ASME A112.18.1/CSA B125.1.
e. **Drain:** Grid with NPS 1-1/2 (DN 40) tailpiece.

3. **Waste Fittings:** NPS 1-1/4 (DN 32) minimum waste and trap complying with ASME A112.18.2/CSA B125.2.

4. **Support:** ASME A112.6.1M, Type III lavatory carrier.

### 2.8 DRINKING FOUNTAINS

**A. Drinking Fountains**<Insert drawing designation>: Back access.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   
a. [Acorn Engineering Company](#)
b. [Bradley Corporation](#)
c. [Metcraft Industries Inc](#)
d. [Willoughby Industries, Inc](#)

2. **Fixture:**
   
a. **Standard:** ASME A112.19.3/CSA B45.4.
b. Material: 0.078-inch (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.

c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.

d. Receptor: Bowl with backsplash.

e. Bubbler Supply Valve: Push-button actuation and [backsplash-] [or] [deck-] mounted filler spouts complying with ASME A112.18.1/CSA B125.1.


4. Mounting: Bolts through wall into accessible service space.

5. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.

B. Drinking Fountains <Insert drawing designation>: Front access.

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

   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.

2. Fixture:

   b. Material: 0.078-inch (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Receptor: Bowl with backsplash.
   e. Bubbler Supply Valve: Push-button actuation and [backsplash-] [or] [deck-] mounted filler spouts complying with ASME A112.18.1/CSA B125.1.


4. Mounting: Bolts from fixture-mounted flanges into wall.

2.9 SHOWERs

A. Showers <Insert drawing designation>: Back access, recessed.

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

   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.
2. Fixture:
   b. Material: 0.078-inch (2.0-mm) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Wall, with showerhead and soap dish.
   e. Temperered Hot- and Cold-Water Supply Valves: Mechanical-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
   f. Shower: Hose with vandal-resistant, hand-held, Vandal-resistant, fixed-type, Vandal-resistant, swivel-type head.
   g. Soap Dish: Recessed, stainless steel.

3. Mounting: Bolts through wall sleeve into accessible service space.

4. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.

B. Showers <Insert drawing designation>: Front access, recessed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.

2. Fixture:
   b. Material: 0.078-inch (2.0-mm) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Wall, with showerhead and soap dish.
   e. Temperered Hot- and Cold-Water Supply Valves: Mechanical-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
   f. Shower: Hose with vandal-resistant, hand-held, Vandal-resistant, fixed-type, Vandal-resistant, swivel-type head.
   g. Soap Dish: Recessed, stainless steel.
   h. Access to Internal Components: Vandal-resistant access panels.

3. Mounting: Bolts from fixture-mounted flanges into wall.

C. Showers <Insert drawing designation>: Front access, surface mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.
2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Wall, with showerhead and soap dish.
   e. [Tempered] [Hot- and Cold]-Water Supply Valves: [Pneumatic] [Mechanical-metering] [Electric-solenoid] type with individual check stops complying with ASME A112.18.1/CSA B125.1.
   f. Soap Dish: Recessed, stainless steel.
   g. Access to Internal Components: Vandal-resistant access panels.

3. Mounting: Bolts from fixture-mounted flanges into wall.

D. Showers <Insert drawing designation>: Back access, accessible, cabinet.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Metcraft Industries Inc.
      c. Willoughby Industries, Inc.

2. Fixture:
   b. Material: 0.078-inch- (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Cabinet [42 or 44 by 36 inches (1065 or 1120 by 915 mm)] [48 by 36 inches (1220 by 915 mm)] with floor[ and top], and with stainless-steel soap dish, towel hook, drain, seat, and grab bar.
   e. [Tempered] [Hot- and Cold]-Water Supply Valves: Mechanical-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
   f. Shower: Hose with vandal-resistant, hand-held head.
   g. Drain: Grid with NPS 2 (DN 50) outlet.

3. Waste Fittings: NPS 2 (DN 50) waste to wall; trap complying with ASME A112.18.2/CSA B125.2.

4. Mounting: Bolts through wall into accessible service space.

E. Showers <Insert drawing designation>: Back access, cabinet.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Bradley Corporation.
      c. Metcraft Industries Inc.
      d. Willoughby Industries, Inc.
2. Fixture:

   b. Material: 0.078-inch (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Type and Configuration: Cabinet [30 by 30 inches (760 by 760 mm)] [32 by 32 inches (815 by 815 mm)] [36 by 36 inches (915 by 915 mm)] with floor[ and top], and with stainless-steel soap dish, towel hook, and drain.
   e. [Tempered] [Hot- and Cold]-Water Supply Valves: Mechanical-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
   f. Shower: [Vandal-resistant, fixed] [Fixed] [Swivel]-type head.
   g. Drain: Grid with NPS 2 (DN 50) outlet.


4. Mounting: Bolts through wall into accessible service space.

2.10 SERVICE SINKS

A. Service Sinks <Insert drawing designation>: Back access, [off] [on] floor.

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

   b. Metcraft Industries Inc.

2. Fixture:

   b. Material: 0.078-inch (2.0-mm-) minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Receptor: Rectangular bowl with high backsplash.
   e. Nominal Size: [20 by 19 inches (508 by 483 mm)] [24 by 19 inches (610 by 483 mm)].
   g. Drain: Grid with NPS 2 (DN 50) outlet.


4. Mounting: Bolts through wall into accessible service space.

5. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.
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 security plumbing fixtures level and plumb according to roughing-in drawings.

B. Install back-access, stainless-steel fixtures as follows:
   1. Install wall sleeve in wall if indicated.
   2. Install fixture on wall sleeve or wall, as indicated, with access from accessible service space.
   3. Extend supply piping from service space to fixture.
   4. Install soil and waste piping from fixture and extend into service space.
   5. Install fixture trap in service space instead of below fixture drain.

C. Install front-access, stainless-steel fixtures as follows:
   1. Install fixture support or mounting bracket.
   2. Install fixture on support; mount components inside of or attached to fixture.
   3. Extend supply piping from pipe space to fixture.
   4. Install trap below fixture and extend soil and waste piping into pipe space.

D. Install vitreous-china fixture service space as follows:
   1. Install fixture support in service space.
      a. Use combination support and waste fitting assembly for water closet.
      b. Use chair carrier for lavatory.
   2. Install fixture on support.
   3. Install components in service space.

E. Install fixture outlets with gasket seals.

F. Install fixtures designated "accessible" according to ICC A117.1 for heights, dimensions, and clearances.

G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible fixtures. Comply with requirements in Section 220719 "Plumbing Piping Insulation."
H. Seal joints between fixtures, 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."

I. 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."

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 requirements for water piping specified in Section 221116 "Domestic Water Piping."

C. Comply with requirements for soil and waste drainage piping specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust flushometer valves and flow-control valves on fixtures.

3.5 CLEANING AND PROTECTION

A. After installing fixtures, inspect and repair damaged finishes.

B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Cleveland Clinic.

END OF SECTION 224600
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. LEED Submittals:
   1. Product Data for Prerequisite WE 1[ and Credit WE 3] [Credit WE 2, and Credit WE 3]: Documentation indicating flow and water consumption requirements.

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 10 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.
2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers <Insert drawing designation>: [Freestanding] [Flush to wall].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.

2. Standards:
   a. Comply with NSF 61.
   b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. Cabinet: [All stainless steel] [Steel with powder-coat finish] [Vinyl-covered steel with stainless-steel top].

4. Bubbler: One, with adjustable stream regulator, located on deck.

5. Control: [Push button] [Foot pedal].


8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap. [Retain "Filter" Subparagraph below only if required.]

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 [precooler], 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 (0.0053 L/s)] [8 gph (0.0084 L/s)] [10 gph (0.0105 L/s)] [14 gph (0.0147 L/s)].
   b. Ambient-Air Temperature: 90 deg F (32 deg C).
   c. Inlet-Water Temperature: 80 deg F (27 deg C).
   d. Cooled-Water Temperature: 50 deg F (10 deg C).
   e. Cooled-Water Storage: <Insert gal. (L)>.
   f. Electrical Characteristics:

      1) Motor Horsepower: [1/6] [1/5] [1/4].
      2) Volts: 120-V ac.
      3) Phase: Single.
4) Hertz: 60.
5) Full-Load Amperes: <Insert value>.
6) Minimum Circuit Ampacity: <Insert value>.
7) Maximum Overcurrent Protection: <Insert amperage>.

B. Pressure Water Coolers <Insert drawing designation>: Wall mounted[, standard] [, wheelchair accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.

2. Cabinet: [Single] [Bi-level with two attached cabinets] [Bi-level with two attached cabinets and with a bi-level skirt kit], [all stainless steel] [vinyl-covered steel with stainless-steel top].

3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.

4. Control: [Push button] [Push bar].

5. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.


7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap. [Retain "Filter" Subparagraph below only if required.]

8. 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.

9. 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.

10. Capacities and Characteristics:
   a. Cooled Water: [5 gph (0.0053 L/s)] [8 gph (0.0084 L/s)].
   b. Ambient-Air Temperature: 90 deg F (32 deg C).
   c. Inlet-Water Temperature: 80 deg F (27 deg C).
   d. Cooled-Water Temperature: 50 deg F (10 deg C).
   e. Cooled-Water Storage: <Insert value>.
   f. Electrical Characteristics:
      1) Motor Horsepower: [1/6] [1/5] [1/4] [1/3].
      2) Volts: 120-V ac.
      3) Phase: Single.
      4) Hertz: 60.
      5) Full-Load Amperes: <Insert value>.
      6) Minimum Circuit Ampacity: <Insert value>.
      7) Maximum Overcurrent Protection: <Insert amperage>.

C. Pressure Water Coolers <Insert drawing designation>: Semirecessed[, standard] [, wheelchair accessible].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.

2. Standards:
   a. Comply with NSF 61.
   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: [All stainless steel] [Vinyl-covered steel with stainless-steel top].

4. Bubbler: One, with adjustable stream regulator, located on deck.

5. Control: [Push button] [Push bar].


   [Retain "Filter" Subparagraph below only if required.]

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.

   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: [8 gph (0.0084 L/s)] [12 gph (0.0126 L/s)].
   b. Ambient-Air Temperature: 90 deg F (32 deg C).
   c. Inlet-Water Temperature: 80 deg F (27 deg C).
   d. Cooled-Water Temperature: 50 deg F (10 deg C).
   e. Cooled-Water Storage: <Insert value>.
   f. Electrical Characteristics:
      1) Motor Horsepower: [1/6] [1/5].
      2) Volts: 120-V ac.
      3) Phase: Single.
      4) Hertz: 60.
      5) Full-Load Amperes: <Insert value>.
      6) Minimum Circuit Ampacity: <Insert value>.
      7) Maximum Overcurrent Protection: <Insert amperage>. 

PRESSURE WATER COOLERS

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12. Support: Mounting frame or brackets for attaching to substrate.

D. Pressure Water Coolers:<Insert drawing designation>: Recessed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.

2. Standards:
   a. Comply with NSF 61.
   b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel.

4. Bubbler: One, with adjustable stream regulator, located on deck.

5. Control: [Push button] [Push bar].


[Retain "Filter" Subparagraph below only if required.]

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 [precooler,] 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: [8 gph (0.0084 L/s)] [12 gph (0.0126 L/s)].
   b. Ambient-Air Temperature: 90 deg F (32 deg C).
   c. Inlet-Water Temperature: 80 deg F (27 deg C).
   d. Cooled-Water Temperature: 50 deg F (10 deg C).
   e. Cooled-Water Storage: <Insert value>.
   f. Electrical Characteristics:

      1) Motor Horsepower: [1/6] [1/5].
      2) Volts: 120-V ac.
      3) Phase: Single.
      4) Hertz: 60.
      5) Full-Load Amperes: <Insert value>.
      6) Minimum Circuit Ampacity: <Insert value>.
      7) Maximum Overcurrent Protection: <Insert amperage>. 

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 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, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
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, gate, or globe shutoff valve on water supply to each fixture. [Install valve upstream from filter for water cooler.] Comply with valve requirements specified in Section 220523 "General-Duty 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 Cleveland Clinic.

END OF SECTION 224716
SECTION 226000 - MEDICAL GAS, VACUUM AND WAGD SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division I specification section, apply to this section.

1.2 SUMMARY EXTENT OF WORK

A. This Section pertains to all labor, equipment and services necessary for and incidental to the installation of piped medical gas and vacuum systems (PMGVS) including oxygen, medical air, medical vacuum, waste anesthesia gas disposal (WAGD), nitrogen, instrument air, nitrous oxide, helium, carbon dioxide, argon, dental air, dental vacuum, laboratory air and mixed gas systems as shown on the drawings and specified herein.

1. Oxygen systems shall be complete to the source valve, ready for connection to the bulk gas supply system.

2. Medical Vacuum, WAGD and Medical Air systems shall be complete, started, tested and ready for use.

3. Nitrous Oxide, Nitrogen, Carbon Dioxide, Helium, Argon and Mixed Gas Systems shall be complete, tested and ready for use.

B. Owner Furnished Materials for installation under this section

1. Supply of gases in cylinders or containers as appropriate for manifolds.

2. Initial supply of liquid (oxygen, nitrogen).

C. Related Sections

1. Section 115313 "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.

2. Section 123553 "Laboratory Casework" for compressed-air outlets in laboratory casework.

3. Section 123570 "Healthcare Casework" for compressed-air outlets in healthcare casework.

1.3 DEFINITIONS AND REFERENCES: All references refer to the most recent edition.
A. National Fire Protection Association (NFPA), NFPA 99 Health Care Facilities.


C. American Society of Sanitary Engineers (ASSE) 6010 Professional Qualification Standards for Medical Gas System Installers.

D. American Society of Sanitary Engineers (ASSE) 6030 Professional Qualification Standards for Medical Gas System Verifiers.

E. ISO 1217 2009 Displacement Compressors - Acceptance Tests

F. ISO 13485 Medical Devices - Quality management systems

1.4 PERFORMANCE REQUIREMENTS

A. All materials used shall be new and of the best grade and quality obtainable and workmanship shall be first class in every respect. Contractor shall be responsible for compliance with all Local, State or Federal codes.

B. Provide all elements and accessories required for complete systems per NFPA 99 most recent edition.

C. Contractor shall make all necessary connections to owner furnished equipment.

D. Install all piping as shown on Drawings, as described herein and as described in Section 15050, Basic Materials and Methods, using methods of fabrication, grading, testing, repairing, cleaning and other procedures as described.

E. Electrical power wiring for vacuum pump(s), medical air compressor(s), WAGD Producer(s), ceiling columns, alarms, and modular accessories associated with the system(s) shall be part of the electrical contract. Any equipment supplied by this contractor that requires additional electrical services shall be the responsibility of this contractor to supply these services.

F. Perform Installer pressure testing, cross connection testing and final testing per NFPA 99 most recent edition and using procedures as specified.

G. Coordinate with owner retained verifier, CHT, for final verification of the systems. Make corrections as required, including additional testing if necessary to attain full and unqualified
certification.

1.5 COORDINATION

A. Medical Gas Contractor shall coordinate with other trades to ensure timely installations and avoid conflicts and interference.

B. Work with metal stud partition installer and/or mason to ensure anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.

C. Coordinate with owner to ensure medical gas outlets, whether owner supplied or contractor supplied, in walls, ceiling and all equipment is provided by the same Medical Gas Equipment Manufacturer (MGEM) satisfactory to the owner.

D. Coordinate with bulk cryogenic gas supplier for installation, connection and verification of bulk gas supply systems.

E. Medical Gas Contractor shall supply and install the master alarm system, including the signal wiring. The electrical contractor shall provide power wiring to each alarm panel. Medical Gas Contractor is responsible for proper termination, testing and marking of alarm panels. Termination shall be done by or under supervision of manufacturer of alarm panels and medical gas verifier.

F. Coordinate with Medical Gas Verifier to deliver a complete, tested medical gas installation ready for owner’s use with as built drawings and documentation.

1.6 SUBMITTALS

A. Furnish the following as one package:

1. Medical Gas Equipment Manufacturer (MGEM) submittals including at least;
   a. A list of certifications currently maintained by the manufacturing facility(ies). Specifically, certificates for ISO 13485 or 9001 (13485 preferred) and UL or equivalent shall be included.
   b. Complete specifications for the product intended to be installed, dimensional drawings, and wiring schematics where appropriate.
c. For Medical Air, medical vacuum and WAGD plants include:

(i) Package drawing indicating package style, dimensions when complete, method of disassembly and sizes of subsections for rigging and installation.

(ii) Compressor and package capacity expressed in ICFM.

(iii) Lubrication method (if any).

(iv) Drive detail including adjustment method.

(v) Motor including manufacturer, frame type, service factor, horsepower, current draw, and RPM.

(vi) Air filters including type and replacement element.

(vii) Pressure regulators including type and manufacturer.

(viii) Dew point monitor including technology employed, calibration interval, and annual drift in degrees.

(ix) Carbon monoxide monitor including technology employed, calibration interval, and annual drift in ppm.

(x) Air dryers, type; manufacturer; and design dew point at 50 psig.

(xi) Sound pressure in dBa when operated at NFPA capacity.

(xii) BTU output for the equipment.

d. For other medical gas products include:

(i) Outlet keying system.

(ii) Alarms networking instructions.

e. Complete installation instructions for the use of the installer.

f. Statement of specific compliance with paragraphs of NFPA 99 most recent edition as relevant to the equipment and as listed in those sections.

g. Complete maintenance schedules.

h. Warranty statement which must encompass all system components. Warranties covering only specific components or containing exclusions are not acceptable.

i. Name and contact information for local installation assistance, startup, warranty
and service. Provide at least one local service contact and a backup service contact physically located within 250 miles of the facility.

j. Description of available Preventative Maintenance programs for Owners review.

k. Information on training programs available to maintenance personnel for Owners review.

B. Medical Gas Verifier Submittals shall include:

1. Name, contact information, NITC Credential Number and reference list. Reference list to include not fewer than three references on projects of similar size and complexity.

C. Pre-approval:

1. Written pre-approval is required for equipment not exactly matching specifications. Submit the information required under Submittals above, attaching a cover letter stating the exact areas of deviation.

2. A Request for pre-approval of equipment must be received by the Engineer not less than five business days prior to bid.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements

1. Electrical Control systems and Medical Gas Alarms are to be UL listed as assemblies with label affixed.

2. Medical air, instrument air, medical vacuum and WAGD controls are to be wired in accordance with NEC.

3. MGEM will include with submittals an affidavit attesting to compliance with all relevant paragraphs of NFPA 99 most recent edition.

4. MGEM personnel assembling medical air, instrument air, vacuum and WAGD plant shall meet NFPA 99 5.1.10.10.11 “Qualification of Installers” and hold medical gas endorsements as under ASSE 6010.

5. The Contractor shall furnish documentation attesting that all installed piping materials were purchased cleaned and complied with the requirements of NFPA 99 5.1.10.1 and
5.1.10.2. Contractor must also provide Cleveland Clinic with Certificates of Conformance indicating that all piping materials meet the metallurgical specifications set forth in ASTM B819.

Note: The above-mentioned documentation must be submitted to Cleveland Clinic prior to the verification process being performed.

6. The Contractor shall furnish copies of ASSE 6010 qualifications for all workers installing medical gas piping.

B. Installation and Start-up: The MGEM will provide factory authorized representatives to review installation and perform initial start up and program setup of system.

C. Warranty

1. Warranty will be expressly complete, include all components of the system and be the responsibility of the MGEM of record only. Warranties limiting the responsibility of the MGEM for any system component or which pass through the MGEM to another manufacturer are not acceptable.

2. Warranties shall include on site repairs including travel, labor and parts. Warranties requiring return of equipment for adjustment are not acceptable.

3. All medical gas pipeline components shall be warranted by the MGEM of record for 24 months or longer from start-up.

4. Medical Air dryer switching valves shall be warranted by the MGEM of record for 10 years from start-up.

D. Maintenance

1. MGEM shall demonstrate a national factory direct service capability able to perform major overhauls.

2. MGEM shall offer factory direct preventative maintenance contract for the owner’s consideration.

3. MGEM shall offer formal maintenance training courses for owners review.

E. Verification: Medical Gas Contractor shall deliver to the owner a complete system
certification without qualifications.

PART 2 - PRODUCTS

2.1 QUALIFICATION OF MANUFACTURER(S)

A. One Medical Gas Equipment Manufacturer (MGEM) shall supply the medical-gas system(s) and equipment to include outlets, valves and gauges, valve boxes, alarm panels, manifolds, medical air, instrument air, vacuum and WAGD sources.

B. The MGEM shall have a product specialist available to periodically check with the Contractor during installation of the pipeline systems equipment. MGEM shall provide service support to the hospital after turnover. Demonstrate factory trained service technician is available within 200 miles of facility.

C. Approved MGEM: Piping Systems Components and Medical Gas Alarms;
   1. Beacon Medæs
   2. Note that written Pre-approval by Cleveland Clinic Facilities Engineering Department is required for all equipment from other manufacturers.

2.2 MATERIALS

A. All pressurized medical gas piping shall be;
   1. Seamless ASTM B-819, type K or L hard drawn seamless medical gas copper tubing, identified by the markings “OXY” “MED” “OXY/MED” “OXY/ACR”, or “ACR/MED” in green (Type K) or blue (Type L).
   2. Fittings shall be wrought copper, brass or bronze designed expressly for brazed connection, compliant with ANSI B16.22.
   3. Pipe (Tube), fittings, valves, and other components shall be specially cleaned for oxygen service in a facility equipped to clean, rinse, and purge the material in accordance with the requirements of NFPA 5.1.10.1.1 and received on job site cleaned and capped. On site cleaning of the interior surfaces of tubes, valves, fittings, and other components is not
4. Brazing alloy shall be BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

B. All vacuum tubing shall be:

2. Brazed with BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

C. All WAGD piping shall be:

2. If copper, brazed with BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

D. Isolation of copper tubing from dissimilar metal shall be accomplished either through use of copper or copper plated hangers or hangers with plastic isolators.

2.3 SUBSYSTEMS

A. Liquefied Bulk Gas Sources

1. The liquid bulk gas source(s) shall be provided by the gas supplier under separate contract with the Owner. Medical Gas Contractor to coordinate with supplier and verifier to ensure a complete and verified installation properly connected to the Medical Gas contractor’s work.
2. The concrete equipment pad, concrete delivery pad and fencing shall be furnished under other divisions.
3. Lighting and electrical power shall be furnished and installed under Division 26. The Medical Gas Installer shall coordinate installation and connection of signal wiring to alarm panels.
4. Medical gas contractor shall install and verify prior to the installation of the liquid bulk
gas source(s):

a. The main line from the equipment location to the building, stubbed up and capped at the equipment pad in the location determined by consultation with the Contractor installing the source.

b. The main line valve.

c. Emergency oxygen inlets, with supply line and associated components in locations as required by NFPA 99 5.1.3.4.14, as otherwise in accordance with NFPA 99, and as indicated on the drawing. Emergency oxygen supply connection shall be as manufactured by Beacon Medaes.

5. If the Emergency Oxygen Inlet location as shown on drawings is not found to be accessible by delivery vehicles for any reason, inform the engineer for possible relocation prior to final installation.

B. Gas Cylinder Manifolds

1. Manifolds shall meet the requirements of NFPA 99 5.1.3.4.9. and 5.1.3.4.10.

2. The manifold control(s) shall be fully automatic, including shifting to secondary bank when the service bank is exhausted, with automatic reset of replaced bank to primary status. Semi-automatic manifolds are not acceptable.

3. The manifold control(s) shall incorporate:

   a. Pressure switches to actuate designated signals when service bank is exhausted.

   b. Visible display on control unit to determine when primary bank is exhausted and the secondary bank is in operation.

   c. A continuously lit green indicator to indicate header in use.

   d. Gauges to indicate contents of each header.

   e. An amber indicator of header ready for the secondary header.

   f. A red indicator of header empty for each header.
g. A pressure gauge for line pressure.

4. Manifold design shall ensure that the failure of any one component does not prevent continued supply of gas to patients.

5. Manifolds design shall incorporate dome biased regulators for header switching and shall not require heaters for any gas.

6. Alarm Manifold power supply shall be separate unit for ease of installation. Wiring between manifold and power supply shall be manufacturer supplied. Manifolds requiring electrical work inside the manifold cabinet during installation are not acceptable.

7. Wiring shall terminate in power supply box not in manifold. Power supply box shall include terminals for all NFPA mandated alarm signals per Table A-5.1.9.2.

8. Oxygen manifolds shall not include polymeric materials.
   a. Furnish Copper pigtails. Flexible leads with polymeric linings are not acceptable.
   b. Cylinder check valves shall contain no Teflon or Kel-F.
   c. Header valves shall be furnished with copper seats.

9. Manifolds shall be designed to permit cylinders to be placed under the manifold controls.

10. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the anticipated number of cylinders while attached to the manifolds.

11. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the number of cylinders indicated on the plans while in storage.

12. Manifolds using gauges which require electrical power are not acceptable.

13. Manifolds which cannot perform switching operations as per NFPA 99 5.1.3.4.10.5 without electrical power are not acceptable.

14. Manifolds shall be BeaconMedæs LifeLine series with sizes as scheduled on the plans.

C. Liquid Container Manifolds

1. Manifolds shall at least meet the requirements of NFPA 99 5.1.3.4.12.
2. The manifold control(s) shall be fully automatic, including shifting to secondary bank when the primary bank is exhausted with automatic reset of replaced bank to reserve status. Semi-automatic manifolds are not acceptable.

3. The manifold control(s) shall incorporate:
   a. Pressure switches to actuate designated signals.
   b. Visible display on control unit to indicate when either bank is exhausted and the secondary bank is in operation.
   c. An indicator of header ready for the secondary header.
   d. Visible display on power supply box to indicate when Reserve is in operation.
   e. Visible display on power supply box to indicate when reserve contents are low.
   f. A continuously lit green indicator to indicate header in use.
   g. Gauges to indicate contents of each header.
   h. A pressure gauge for line pressure.

4. Manifold shall include all reserve header components necessary to complete a manifold with reserve. Header shall include at least the number of connections scheduled on the plans.

5. Reserve headers shall be separate sub assemblies suitable for mounting separate from the manifold controls using standard Type K tubing and brazing techniques. No special piping materials or techniques shall be required.

6. Alarm Manifold power supply shall be separate unit for ease of installation. Wiring between manifold and power supply shall be manufacturer supplied. Manifolds requiring electrical work inside the manifold cabinet during installation are not acceptable.

7. Wiring shall terminate in power supply box not in manifold. Power supply box shall include terminals for all NFPA mandated alarm signals per Table A-5.1.9.2. Wiring between the power supply and reserve pressure switch shall be by installing contractor.
8. Manifold design shall ensure that the failure of any one component does not prevent continued supply of gas to patients.

9. Manifolds design shall incorporate dome biased regulators for header switching and shall not require heaters for any gas.

10. Oxygen reserve headers shall not include polymeric materials.
   a. Furnish Copper pigtails. Flexible leads with polymeric linings are not acceptable.
   b. Cylinder check valves shall contain no Teflon or Kel-F.
   c. Header valves shall be furnished with copper seats.

11. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the anticipated number of containers and cylinders while attached to the manifolds.

12. Contractor shall furnish and install or field fabricate storage racks adequate to restrain the number of containers and cylinders indicated on the plans while in storage.

13. Manufacturer shall include with the manifold one copy of an applications guide describing the operation of liquid manifolds and their limitations for the operator’s use.

14. Manifolds using gauges which require electrical power are not acceptable.

15. Manifolds which cannot perform switching operations as per NFPA 99 5.1.3.4.10.5 without electrical power are not acceptable.

16. Manifolds shall be Beacon Medæs LifeLine series with sizes as scheduled on the plans.

D. Manifold Room Monitors

1. Furnish each manifold room with an oxygen deletion monitor mounted in the manifold room at 1.5 meters (5 feet) AFF in a position where cylinders will not contact the sensor or meter. Monitors indicate oxygen low level at 19.5% and a second indication at 18%. Audible and visual indication is provided.

2. Provide audible and visual indicator outside door at 1.5 meters (5 feet) AFF to alert operator prior to entry. Label “Oxygen Low – Do Not Enter”
3. Monitors are provided with volt free contact for connection to master alarm.

E. Medical Vacuum Pumps

1. Provide a complete medical vacuum source, complying with NFPA 99 5.1.3.6 in all respects, as specified and scheduled on the drawings and as manufactured by BeaconMedæs or pre approved equal.

2. All components shall be at least duplexed and valved (or check valved as provided in NFPA-99) to permit service to any component without interrupting vacuum supply to the facility during any maintenance operation or any condition of single fault failure. Each pump exhaust shall be isolated by a ball valve for service isolation.

3. Furnish complete plant consisting of pumps, receiver and controls capable of providing the scheduled capacity with one pump out of service. All capacities will be indicated in SCFM at 19 inches HG.

4. System is entirely on a single base or a base which can be separated in the field for rigging. If separable, bases are prepared for separation from the factory. System or system sections fit through a standard 36 inch door frame.

5. System piping uses o-ring sealed flanges and SAE O ring or flare fittings for minimum leaks and easy repair. Valves are butterfly or ball type, positive seal with three piece disassembly.

6. System is completely factory assembled. Field connections are (1) inlet line (from facility), (1) outlet, and (1) electrical conduit and power. Systems requiring site assembly are not acceptable (except reattachment of sections separated on site at contractor’s convenience).

7. System base, frames, control cabinet, piping and receiver are powder coated for durable and attractive finish.

8. Each pump will include corrugated metal inlet and outlet flex connectors factory installed by the MGEM. Systems employing plastic or rubber hoses for flex connectors are not acceptable.
FOR CLAW

9A. Provide non contacting claw style rotary pumps. Internal construction is friction free and rotors are non-contacting. Air end is oil free and requires no sealants. Each pump is air cooled and continuous duty rated. Pump is provided with a single lubricated gearbox requiring oil change not more often than annually. MGEM offers a testing service for pump oil to allow less frequent changes. Pump is provided with exhaust silencer. Pumps are equipped with high vacuum shutdown and high temperature shutdown.

FOR LIQUID RING (REQUIRED FOR LABORATORY USE)

9B. Provide oil-free, single-stage positive displacement, and non-pulsating liquid ring type pumps. The pump will be fitted with mechanical seals. Each pump will be of all iron construction with a bronze or stainless rotor and carbon steel shaft. Maintenance intervals are calendar based and there is no hours based maintenance. Under normal operation, system shall minimize fresh seal water required. System shall include reservoir sufficient for up to 48 hours operation without fresh water supply. System is self-contained. Provide Beacon Medaes systems utilizing NASH pumps or preapproved equal.

FOR OIL LESS ROTARY VANE

9C. Provide completely dry pumps equipped with self-lubricating carbon/graphite vanes. Bearings shall be lubricated and sealed. No oil is permitted in any pump. Each pump is completely air-cooled and has absolutely no water requirement. Each pump is fitted with a 5 micron inlet filter and is equipped with a vacuum relief valve, check valve to prevent backflow through off-cycle units, flexible connector, isolation valve, and vibration isolators at each mounting location. Provide Beacon Medaes packaged vacuum system or preapproved equal.

10. Each pump will be direct or close coupled to a NEMA rated Premium Efficiency TEFC motor with a service factor of 1.15.

11. Control system in contained in a cabinet factory prepunched for conduit connections. Provide three punches: for power in sized per NFPA 70 Article 310 and based on total system amperes and for communications and for master alarm wiring, each sized at ½”. The control system is built and labeled in a UL approved panel shop operating under ISO 13485 (Medical Device) registration. Provide in the control system door:
a. 16 bit, full color, VGA resolution touch screen display for system functions and system level control.

b. Separate 16 bit, full color half VGA resolution touch screens for display of pump functions and pump control. These controls provide selector control of Automatic, Manual (continuous run) or Off for each pump.

c. A separate disconnect handle with door interlock for each pump (note for systems greater than triplex, only two disconnect handles shall be required).

d. Audio sounder capable of 80 dB at 3 feet with mute function provided by the controls.

e. Power on lamp illuminated whenever any disconnect is On.

12. Provide in the control cabinet interior:

a. Full voltage motor starters with overload protection, one per pump.

b. Circuit breaker disconnects, one for each pump (note: for multiplex units greater than triplex, only two circuit breakers are required) operated by the through the door disconnect handle.

c. Redundant 24 Volt DC control circuit transformers including power seeking function in the event one power supply fails.

d. Power distribution terminal block convenient for main power entry.

e. All internal circuit boards and components needed for operation of the control system as described below.

f. Volt free contacts for connection to master alarms.

g. Controls circuitry shall be 24 Volts DC for worker safety. No system component other than the drive motors shall require greater than 24V for operation.

13. The control system shall provide for the following functionality:

a. Display of vacuum and VSD speed (if provided) on a single display for at a
glance checking.

b. Automatic lead/lag sequencing and alternation. Display clearly shows status of each pump including running unit, next-unit-in-sequence, and units unavailable to run.

c. Runtime hour-meters for each pump.

d. In the event of control failure the system shall activate all alarms and operate on a simple on/off basis until repaired.

e. When H-O-M selectors are in Manual mode, system will operate on vacuum switch and pump will not run if lead switch is satisfied.

f. Controls provide visual and audible alarm indication and isolated contacts for remote alarm for at least Lag Pump in Use, and High Temperature (for each pump unit alone or system together).

h. Controls provide automatic indication of major maintenance intervals and details of required maintenance kits.

i. Controls provide distinct separate indication on the control screens of alarms which shutdown the pump vs. alarms which do not shut down the pump vs. maintenance notifications.

j. Controls provide isolated contacts for remote alarms which can distinguish between a condition which shuts down the unit, A condition which does not shut down the system and A maintenance alert.

k. Control system permits individual test of lag in use, high temperature and controls fault alarm points from the touchscreen. System shall include low level testing of controls, local and connected master (source) alarms.

l. Controls permit automatic “bumping” of the pumps to test rotation.

m. Control system logs and allows review of all alarm and shutdown events.

n. Control system is highly redundant and robust allowing for multiple failures before becoming unable to make air. Control systems which can lose any single component and fail to make air are not acceptable.
o. Controls include an integral webserver using standard Ethernet allowing observation of system operating parameters from any remote location on the same network with any standard web browser. Systems requiring special software are not acceptable.

p. Controls provide autodiscovery from and of any Total Alert alarm on the same network allowing for system wide linking and inspection of any networked component through any single connection.

14. The complete medical vacuum system and all electrical components shall be factory pre-tested prior to shipment by the MGEM.

F. Medical Air Compressor System, Scroll

1. Provide a complete medical air source, complying with all relevant requirements of NFPA 99 5.1.3.5 and supplying medical air continuously for the life of the equipment. The unit shall be manufactured by Beacon Medaes or pre-approved equal.

2. Furnish a complete plant consisting of compressors, receiver, air treatment system and controls capable of providing scheduled capacity with one compressor out of service and complying with 3-10 below.

3. System is entirely on a single base or a base which can be separated in the field for rigging. If separable, bases are prepared for separation from the factory. System or system sections fit through a standard 36 inch door frame.

4. System is completely factory assembled. Field connections are (1) inlet line, (1) outlet (to facility), (1) electrical conduit and power and (1) line to floor drain. Systems requiring site assembly are not acceptable (except reattachment of sections separated on site at contractor’s convenience).

5. System base, frames, control cabinet and receiver are powder coated for durable and attractive finish.

6. The compressor modules and motors shall be fully isolated from the main compressor base by means of a four point, heavy-duty isolation system for a minimum of 95% isolation efficiency. System is engineered for equal weight distribution between four
isolation points. Systems not having this feature shall have an inertia base sized for that system installed at this contractor's expense.

7. Flexible connections between compressor units and the structure shall be provided for all inlets and outlets. Vibration flexes are all metal and of sufficient length to achieve full isolation. Systems using rubber tubing flex connectors with hose clamps are not acceptable. Systems with short flex connections providing only nominal isolation are not acceptable. Inlet flexes are corrugated metal with outer stainless braid. Outlet flexes are metal and double wall with thermal isolation.

8. Any piping or connection which may exceed 150 degrees F. is guarded to prevent contact burns. Belt and fans are guarded to prevent worker injury. Hazard labeling alone is not acceptable.

9. The compressors shall be a continuous duty rated scroll type. The design shall be single stage, air-cooled, consisting of one fixed and one orbiting scroll sealed with PTFE tip seals between the scroll halves and rated for 828 kPa (120 PSIG) discharge pressure. Orbiting bearings shall be grease filled. Compressors shall be field serviceable for tip seal change and bearing lubrication. Non-field serviceable scroll compressors are not acceptable. Noise level shall not exceed 75 dB(A) for duplex system, 78 dB(A) for triplex system, and 80 dB(A) for quad system with pumps running at peak demand. Belt tensioning shall be achieved with a sliding motor mounting base adjustable with two tensioning screws. Each compressor unit shall be equipped with a distinct after cooler with separate cooling fan designed for a maximum approach temperature of 7°C (15°F) at 37.8°C (100°F) ambient and complete with electronic drain valve. Designs using compressor cooling air for the aftercooler are not acceptable. The discharge of piping of each compressor shall incorporate an electronic solenoid valve to prevent reverse rotation of the scroll at shutdown.

10. Control system in contained in a cabinet factory prepunched for conduit connections. Provide three punches: for power in sized per NFPA 70 Article 310 and based on total system amperes and for communications and for master alarm wiring, each sized at ½”. The control system is built and labeled in a UL approved panel shop operating under ISO 13485 Medical Device registration. Provide in the control system door:

a. 16 bit, full color, VGA resolution touch screen display for system functions and system level control
b. Separate 16 bit, full color half VGA resolution touch screen for display of compressor unit functions and compressor unit control. These controls provide selector control of Automatic, Manual (continuous run) or Off for each compressor unit.

c. A separate disconnect handle with door interlock for each compressor unit (note: for multiplex units greater than triplex, only two disconnect handles shall be required)

d. Audio sounder capable of 80 dB at 3 feet with mute function provided by the controls.

e. Power on lamp illuminated whenever any disconnect is On.

11. Provide in the control cabinet interior:

a. Full voltage motor starters with overload protection, one per compressor unit.

b. Circuit breaker disconnects, one for each compressor unit (note: for multiplex units greater than triplex, only two circuit breakers are required) operated by the through the door disconnect handle.

c. Redundant 24 Volt DC control circuit transformers including power seeking function in the event one power supply fails.

d. Power distribution terminal block convenient for main power entry.

e. All internal circuit boards and components needed for operation of the control system as described below.

f. Volt free contacts for connection to master alarms.

g. Controls circuitry shall be 24 Volts DC for worker safety. No system component other than the drive motors shall require greater than 24V for operation.

12. The control system shall provide for the following functionality:

a. Display of pressure, dew point and carbon monoxide level on a single display for at a glance checking.
b. Automatic lead/lag sequencing and alternation. Display clearly shows status of each compressor unit including running unit, next-unit-in-sequence, and units unavailable to run.

c. Runtime hour-meters for each compressor unit.

d. In the event of control failure the system shall activate all alarms and operate on a simple on/off basis until repaired.

e. When H-O-M selectors are in Manual mode, system will operate on pressure switch and compressor units will not run if lead switch is satisfied.

f. Controls provide visual and audible alarm indication and isolated contacts for remote alarm for at least Dew Point High, CO High, Lag Compressor in Use, and High Temperature (for each compressor unit alone or system together).

h. Controls provide automatic indication of major maintenance intervals and details of required maintenance kits.

i. Controls provide distinct separate indication on the control screens of alarms which shutdown the compressor vs. alarms which do not shut down the compressor vs. maintenance notifications.

j. Dryers are controlled from control panel with controls integral to touchscreen system. System includes maintenance alerts and diagnostics for dryers.

k. Controls provide isolated contacts for remote alarms which can distinguish between a condition which shuts down the unit, A condition which does not shut down the system and A maintenance alert.

l. Control system permits individual test of Dew point, CO, lag in use, high temperature and controls fault alarm points from the touchscreen. System shall include low level testing of controls, local and connected master (source) alarms.

m. Controls permit automatic “bumping” of the compressors to test rotation.

n. Control system logs and allows review of all alarm and shutdown events.

o. Control system logs and allows review of all maintenance events.
p. Control system is highly redundant and robust allowing for multiple failures before becoming unable to make air. Control systems which can lose any single component and fail to make air are not acceptable.

q. Controls include an integral webserver using standard Ethernet allowing observation of system operating parameters from any remote location on the same network with any standard web browser. Systems requiring special software are not acceptable.

r. Controls provide autodiscovery from and of any Total Alert alarm on the same network allowing for system wide linking and inspection of any networked component through any single connection.

13. Compressor motors shall be a NEMA Premium Efficiency rated, open drip proof unit with 1.15 service factor suitable for 208 or 230/460 volt, three phase, 60hz.

14. All moving parts (fans, pulleys and belts) shall be fully protected by OSHA acceptable enclosures and guards.

15. A temperature sensor at the outlet of each compressor cylinder or air-end to provide high temperature alarm and shutdown that compressor. Systems employing a single switch for multiple cylinders or air-ends are not acceptable.

16. Provide redundant medical air treatment systems including desiccant dryers, filters, and purifiers sized for NFPA system output. Include dew point and carbon monoxide monitoring. Medical air treatment shall include:

   a. Desiccant dryers producing a 10°F (-12°C) pressure dew point. Refrigerant dryers are not acceptable.

   b. Dryer purge flow control through an integral dew point based purge control system. Purge controllers using desiccant temperature are not acceptable.

   c. 441 transfer valve utilizing two ceramic slide plates. Units utilizing multiple solenoids or diaphragm type switching are not acceptable. Valve shall require no periodic service and be covered by a 5 year factory warranty.

   d. Mounted coalescing pre-filter rated for 0.01 micron with automatic drain and
element change indicator at the inlet to each dryer.

e. Final line filters rated for 1 micron with element change indicators (per NFPA 99 5.1.3.5.8(3)&(4)), duplexed final line regulators, and duplexed safety relief valves shall be factory mounted and piped at the outlet of each dryer.

f. Sensors for dew point and CO sensors are provided with a DISS demand check per NFPA 5.1.8.2.4.

17. System piping is welded except where unions are required for service or where piping connects to valves or system components. Main flow path joints are flanged and provided with seals, use 37° SAE flares suitable for flaretight seals or SAE straight thread with O-ring seal for leak tight connection and ease of replacement or service. NPT fitting use is minimal.

18. Provide corrosion resistant, powder coated, ASME Coded, National Board Certified receiver rated for a minimum 150 PSIG design pressure. Include a liquid level glass with bead, safety relief valve, manual drain valve, and zero loss tank drain. Systems employing timed solenoid type drain valves are not acceptable.

19. The complete medical air package shall be pre-wired, pre-piped and assembled on one common base with single point connections for electrical, intake air, discharge air, and condensate drains. All piping shall be factory complete including all valves per NFPA 99 Fig. A-5.1.3.5.11.6.

20. The complete medical air system and all electrical components shall be factory pretested prior to shipment by the MGEM.

G. Waste Anesthetic Gas Disposal Pumps

1. Provide a complete WAGD source, complying with NFPA 99 5.1.3.7 in all respects, as specified and scheduled on the drawings and as manufactured by BeaconMedæs or pre-approved equal.

2. All components shall be at least duplexed and valved to permit service to any component without interrupting WAGD supply to the facility during any maintenance operation or any condition of single fault failure.

3. Furnish complete plant consisting of producer and controls capable of providing the
scheduled capacity with one producer out of service.

4. System shall be completely factory assembled. Systems requiring site assembly are not acceptable (removal of components for shipping is permitted).

5. Each producer will include inlet and outlet flex connectors supplied by the MGEM.

6. Programmable Logic Controllers (PLC) will be used to implement operating logic. PLC will have integral memory and EPROM backup. PLC shall control the automatic alternation of the producers with provisions for simultaneous operation if required, and automatic activation of reserve unit if required. A lag alarm on control cabinet and contacts for the master alarm will be provided.

7. The complete control system and all electrical components shall be NEMA 12 and UL labeled. The control system shall provide:
   
a. Automatic lead/lag sequencing.

b. Circuit breaker disconnects for each producer with external operators. Units with fuses instead of circuit breakers in motor circuit are not acceptable.

c. Full voltage motor starters with overload protection.

d. Redundant 120 volt control circuit transformers.

e. Visual and audible reserve unit alarm with isolated contacts for remote alarms and audio cancel.

f. Control cabinet shall have lighted HOA selector switches

g. Runtime hour-meter for each producer.

FOR LIQUID RING

8A. Provide oil-free, single-stage positive displacement, and non-pulsating liquid ring type pumps. The pump will be fitted with mechanical seals. Each pump will be of all iron construction with a bronze or stainless rotor and carbon steel shaft. Maintenance intervals are calendar based and there is no hours based maintenance. Under normal operation, system shall minimize fresh seal water required. System shall include
Reservoir sufficient for up to 48 hours operation without fresh water supply. System is self contained. Provide vacuum regulation to maintain a maximum system vacuum of 177 mmHg (7inHg). Provide BeaconMedaes packaged WAGD system using NASH pumps or preapproved equal.

FOR CLAW

8B. Provide non contacting claw style rotary pumps. Internal construction is friction free and rotors are non-contacting. Air end is oil free and requires no sealants. Each pump is air cooled and continuous duty rated. Pump is provided with a single lubricated gearbox requiring lubricant change not more often than 5,000 operating hours. Pump is provided with exhaust silencer. Pumps are equipped with high vacuum shutdown, high temperature shutdown and alarm. Lubricant supplied shall be inert with oxygen. Pump shall be provided with vacuum modulated variable speed drive to control vacuum level at 177 mmHg (7inHg). Provide BeaconMedaes OxyAssured pump or preapproved equal.

9. The complete WAGD system and all electrical components shall be factory pre-tested prior to shipment by the MGEM.

H. Instrument Air Compressor System

1. Provide a complete Instrument air source, complying with all relevant requirements of NFPA 99 5.1.3.8 and supplying instrument air continuously for the life of the equipment.

2. All components are valved to permit service to any component without interrupting instrument air supply to the facility.

3. Furnish a complete plant consisting of duplex compressors, receiver, duplex air treatment systems and controls capable of providing scheduled capacity with one compressor out of service.

4. System is single point, allowing for single point connection of outlet, power and drain. Unit shall be constructed to permit disassembly into sections each to fit through a standard 36 inch door frame on a standard pallet jack. Systems shipped in components and requiring site assembly are not acceptable.
5. Compressor shall be oil lubricated, two stage compression capable of continuous output of 200 psig or greater and provided with aftercooler and interstage drain trap to prevent low-usage emulsification of lubricating oil.

6. The control system is NEMA 12 and UL labeled. Provide in the control system:

   a. Automatic lead/lag sequencing and alternation (duplex compressor only)

   b. Circuit breaker disconnects for each compressor internal to the main control cabinet and protected by the safety interlock of that cabinet.

   c. Full voltage motor starter(s) with overload protection.

   d. Redundant 24 Volt DC power supplies (duplex compressor only). Entire control circuit is 24 v DC for operator safety.

   e. Visual and audible reserve unit alarm with isolated contacts for remote alarm and cancelable audio.

   f. HOA lighted selector switches.

   g. HMI display and interface which shall display:

      (i) Runtime hour-meters for each compressor.

      (ii) Visual and audible alarm indication of dew point.

      (iii) Visual and audible alarm indication for high discharge air temperature shutdown.

      (iv) Maintenance required.

      (v) Compressor settings and operating parameters.

      (vi) Compressor operating history.

   h. If main controls fail or when HOA switches are in Hand mode, system will operate on backup pressure switch.

   i. Provide with isolated contacts for remote alarm.
j. Controls to activate the reserve manifold if the compressor is unable to supply the system. HMI and volt free contact will activate to indicate Reserve in Use. Manifold is provided with pressure switch to indicate Reserve Contents Low at HMI and volt free contact. (simplex compressor only)

7. Compressor motors shall be a NEMA rated, open drip proof unit with 1.15 service factor suitable for 208 or 230/460 volt.

8. All moving parts (fans, pulleys and belts) shall be fully protected by a OSHA approved enclosure.

9. All support structures shall be minimum of 10 Gauge Steel.

10. The compressor modules and motors shall be fully isolated from the main compressor base by means of a four point, heavy-duty isolation system for a minimum of 95% isolation efficiency. Engineering data shall be provided supporting isolation efficacy and equal weight distribution between supports.

11. Provide redundant instrument air treatment systems including desiccant dryers, filters, and purifiers sized for peak calculated demand. Include dew point monitor. Air treatment shall include:

   a. Desiccant dryers producing a -40°C (-40°F) pressure dew point.

   b. Mounted pre-filter rated for 0.01 micron with automatic drain and element change indicator at the inlet to each dryer.

   c. Final line coalescing filters rated for 0.01 micron with element change indicators, charcoal adsorbers, duplexed final line regulators, duplexed safety relief valves shall be factory mounted and piped at the outlet of each dryer.

12. System piping shall be brazed except where unions are required for service. Vibration flexes shall be all metal. Systems using rubber flex connectors with hose clamps are not acceptable.

13. System shall be provided with zero loss drains for all drain traps to reduce losses natural to the operation of the traps.

14. System piping shall be brazed except where unions are required for service. Vibration
flexes shall be all metal. Systems using rubber flex connectors with hose clamps are not acceptable.

15. Provide corrosion resistant, ASME Coded, National Board Certified, receiver rated for a minimum 250 PSIG design pressure. Include a liquid level glass, safety relief valve, manual drain valve, and a screened automatic solenoid valve. During normal operation the flow of air will travel through the tank to allow water to condense in tank.

16. The complete instrument air package shall be pre-wired, pre-piped and assembled on one common base with single point connections for electrical, discharge air, and condensate drains. All elements shall be factory installed excluding source valve. All piping shall be factory complete including all valves per NFPA 99 Fig. A-5.1.3.5.11.6.

17. The compressors shall be two stage, air cooled, reciprocating type capable of 200 psig minimum. Each compressor shall have an aftercooler with approach temp of not greater than 5.6°C (12°F).

18. The complete instrument air system and all electrical components shall be factory pre-tested prior to shipment by the MGEM.

I. MEDICAL GAS OUTLET STATIONS:

1. Medical gas outlet stations shall be modular, quick-disconnect recessed type, or DISS screw thread recessed type equal to BeaconMedaes Series B. Threaded DISS connectors shall be per CGA V-5 standard.

The rough in assembly shall be of modular design and include a gas specific 16 gauge steel mounting plate designed to permit on-site ganging of multiple outlets, on 5 inch center line spacing. A machined brass outlet block shall be permanently attached to the mounting bracket to permit the 1/2” OD, type-K copper inlet to swivel 360 degrees for attachment to the piping system. The rough in assembly shall contain a double seal to prevent gas leakage between the rough in and latch-valve assemblies after the wall is finished. A single o-ring seal shall not be acceptable.

2. Outlets shall be field assembled with sequences and services indicated.

3. Outlet stations shall have a die cast light gray epoxy powder coated trim plate. Furnish indexed rough in and gas specific latch valve with non-interchangeable safety keying and
with color coded gas service identification. The safety keying index pins shall be permanently captured in the latch assembly and non-removable without destroying the outlet. Designs with index pins molded in plastic are not acceptable.

4. The complete outlet shall be made, cleaned and packaged to NFPA 99 Standards, UL Listed and CSA certified. Medical gas outlets shall be cleaned for oxygen service in accordance with CGA Pamphlet G-4.1. The assembly shall be capped and the finish assembly poly bagged for shipment.

5. The latch-valve assembly shall telescope up to 3/4” to allow for variation in finished wall thickness from 1/2” to 1-1/4”.

6. DISS Outlets shall be used for all ceiling mount applications.

7. Furnish hose assemblies for all ceiling outlets for the finished ceiling height as indicated on drawings. Provide each hose with a heavy-duty chain type dual retractor for pressure gases and dual for vacuum. Retractors made of stainless cable are not acceptable. Allow an extra 18” of hose length for retractors.

J. Nitrogen (N2) and Instrument Air (IA) Control Panels;

1. Nitrogen and IA control panels shall be designed to deliver variable pressures to power pneumatic surgical tools.

2. The control panel shall be provided with a 0-300 psig pressure gauge, shutoff valve, pressure regulator, delivery pressure gauge and outlet. A quarter turn of the valve handle shall be required to obtain a fully “open” or “closed” position.

3. An adjustable self relieving type pressure regulator, with a operating range of 10 to 250 psi.

4. Control panels shall be pre-piped internally requiring only external supply line connections. Additional outlets in the same room may be connected to the remote outlet pigtail furnished in the control panel. Remote outlets shall be regulated by the adjustable pressure regulator within the panel and shall match the nitrogen control panel outlet.

5. Control panels shall be available in horizontal or vertical orientation.
K. MEDICAL GAS VALVES

1. All Medical Gas Valves shall be specially prepared for oxygen service and shall conform to NFPA 99 5.1.4 and 5.1.10. Valves shall be ball-type, with Teflon seats and adjusting stem packing gland with Teflon stem seal.

2. Valves are three piece construction with swing out center.

3. Valve ends where copper to brass joint is made are forged, complying with 5.1.10.3.1. Cast valves are not acceptable (5.1.10.3.2)

4. Seals between center section and outer flanges are silicone capable of withstanding 500°F (260°C) during the brazing process.

5. Ball valves shall be rated 600 WOG, actuate from full “ON” to full “OFF” by 90 degree turn of vinyl gripped valve handle.

6. Furnish and install only valves with factory installed type K copper tubing extensions.

7. Valves not in valve boxes shall be provided with locking handles, BeaconMedæs series 4255 (locks to be provided by contractor to owner).

8. All valves shall be cleaned for oxygen, capped and sealed in a polyethylene bag for shipping and storage.

9. Valve boxes shall be constructed of 18 gauge steel with white enamel finish. The valve box shall have a sliding, opaque door with pull ring and clear gauge window. The removable window cannot be replaced when any valve is closed. The frame assembly shall be capable of adjusting for variances in wall thickness up to 1”. The window shall conceal piping and mounting screws. Window shall be labeled “Caution - Medical Gas Shut - Off Valves - Close Only in Emergency.” Provide clear viewing space in the window to display the gas service, the pressure gauges and the label for areas controlled by the valve.

10. Provide color coded self-adhesive gas labels for compliance with NFPA 99 labeling requirements. Apply labels to each valve in the assembly for gas service identification according to manufactures recommendations.
11. Zone valves shall include a 1 1/2 inch pressure gauge reading 0 to 100 psig for oxygen, air, nitrous oxide; 0 to 300 psig for nitrogen; and 0 to 30 HG for vacuum and WAGD. The gauge port shall be equipped with removable plug for pressure testing before final assembly of gauge.

12. All zone valve boxes assemblies shall read pressure downstream and vacuum upstream of the valve per NFPA 99. Valves shall be piped left to right with right being on patient side.

13. All main line, riser, service, and futures valves as scheduled on the drawings shall include plugged 1/8 nptf ports on inlet and outlet.

14. Supply Beacon Medaes specialty zone valve box or approved equal.

L. MEDICAL GAS ALARM SYSTEMS

1. General Requirements
   
a. All Medical Gas Alarm panels shall be UL listed as an assembly and shall include factory wiring, transformers, and circuitry requiring only 115 or 230 volt primary power.

b. Alarm panels shall meet the FCC Part 15, Subpart B and ICES-003 to reduce possibility of magnetic radiation interference with other equipment.

c. The alarm shall arrive on the job site pre-configured as shown on the drawings and schedules or shall be configured by MGEM personnel at no additional charge.

  d. Alarm shall supervise its wiring to sensors and switches, indicating at the relevant panel(s) if any wire is cut, disconnected or open.

  e. Each signal will include an indicator light to signify the condition monitored. Activation of any switch will light its LED and actuate the audio alarm.

  f. Each panel shall include a power on indicator and test function for testing all modules electrically.

  g. Alarms shall include features permitting field adjustment of alarm volume and display intensity.
h. Termination of alarm wiring to be done by or under supervision of manufacturer of alarm.

i. Network communication implementation provides browse, download, configure, and troubleshooting of Master Alarms and Area Alarms with a personal computer that is connected to the facility’s Ethernet. The alarm’s Web pages are built-in; no setup is required.

j. Medical Gas contractor to include as separate price all labor, materials, specialist subcontractors, programming and other costs required for full advertised functionality of alarm network. Contractor shall coordinate with owners Information Technology (I.T.) personnel as required, but is not permitted to use owner’s I.T. personnel for system installation.

k. Alarms shall be compatible with Johnson Control Metasys Building Management System N2 protocol or building information systems.

l. Alarm shall be factory capable of connection to the facility’s Ethernet network. Alarms shall require no special programming or software to allow remote interrogation through any computer on the same intranet. MGEM personnel shall be responsible for alarm configuration at no additional charge.

m. Provide owner with any software and manuals required for interface at time of commissioning at no additional charge.

2. Master Alarms

a. Furnish exact duplicate Master Alarm Panels at the two specified locations. Pipe, cabinets and junction boxes shall be labeled “MED GAS ALARMS”. Pipe should be labeled every 20 feet. Junction boxes are to be kept to a minimum.

b. Wire the master alarm panel’s alarms directly to the individual sensors/switches, furnishing duplicate sensors/switches as required for compliance with NFPA 99 5.1.9.2.4. Wiring shall be installed with a minimum of 22 gauge individually shielded PVC jacketed cable and color coded consistent with existing system.

c. Alarms and sensors shall be functionally tested, labeled and fully operational for owner. Where alarm configuration in software is necessary, it shall be provided
by MGEM representative at no additional charge.

d. Provide alarm points as indicated in NFPA 99 Table A.5.1.9.2. and as detailed on drawings.

e. Master alarm panels shall be fully compatible with owner’s Ethernet network as supplied.

3. Area Alarms

a. Each area alarm shall include a rough in including power supply, a sensor for each specific gas, and one digital display for each specific gas.

b. The power supply shall be of the universal switching type (100-250VAC, 50/60/440Hz, 120-300VDC). Power supply shall be fused to protect the system from voltage and amperage surges. Alarm shall clearly indicate when power is on.

c. The area alarm shall provide an audible and visual signal when an advisory or a fault signal is received. Signal limits shall be factory set, with the ability to be field adjusted without the use of tools.

d. Each panel shall provide continuous digital display of the vacuum or pressure, high pressure LED indicator, low pressure (or vacuum) LED indicator and a Normal LED indicator.

e. The Sensor shall contain a transducer to drive the Digital Module. Sensors shall be gas specific, provided with integral demand checks and capable of mounting directly in the gas pipeline system above the ceiling. Connectors shall be provided for attaching field wiring.

f. The sensor shall include an indicator on the sensor housing allowing visual confirmation of sensor operation from floor level when the sensor is in the ceiling on the piping.

f. Furnish and install the alarm. Coordinate the power wiring with Division 26. Low voltage shielded signal wiring will be provided and installed by this contractor.
g. Termination of signal wiring at alarm location will be done by or under supervision of manufacturer of alarm.

PART 3 EXECUTION

3.1 INSTALLATION

A. Bases and Site preparation

1. Contractor shall furnish 4 inch high concrete housekeeping pads under all medical air, instrument air, vacuum and WAGD plant in this section. Refer to Division 3 for formwork, reinforcement and concrete requirements.

2. Contractor shall furnish inertia bases in lieu of housekeeping pads where the equipment installed is not factory isolated by the manufacturer.

3. Cast anchor bolts into bases.

B. Pipe work

1. All installation shall be performed in strict accordance with NFPA 99 5.1.10. Brazing procedures shall be as detailed in NFPA 99 5.1.10.5. Brazing shall be performed only by brazers qualified under NFPA 99 5.1.10.10.11.

2. Where piping runs underground, install in accordance with NFPA 99 5.1.10.10.5.

3. Copper, tubing, valves and fittings shall be pre cleaned and prepared for oxygen service by the manufacturer and received sealed on the job. Certificates of origin and of proper preparation shall be maintained on the job site attesting the above.

4. The use of flux is prohibited when making of joints between copper to copper pipes and fittings.

5. During any brazing operation, the interior of the pipe shall be purged continuously with oil free, dry nitrogen NF, following the procedure in NFPA 99 5.1.10.5.5. At the completion of any section, all open pipe ends shall be capped using an EXTERNAL cap.

6. Threaded joints in piping systems shall be avoided whenever possible. Where
unavoidable, make up the male threads with polytetrafluoroethylene (such as Teflon) tape. Do not use liquid sealants.

7. Piping shall be supported with pipe trays or hangers at intervals as shown on the drawings or as defined in NFPA 99 Table 5.1.10.4.5. Piping shall not be supported by other piping. Isolation of copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as an isolation material.

8. After installation of the piping, but before installation of the outlet valves, blow lines clear using nitrogen NF.

9. Piping exposed to physical damage shall be protected.

10. Label piping with name of gas service, identification color and direction of flow. Where non-standard pressures are piped, label for pressure. Labels shall be placed at least once every 20 feet of linear run or once in each story (whichever is more frequent). A label shall additionally be placed immediately on each side of each wall or floor penetration. Pipe labels shall be self adhesive vinyl or other water resistant material with permanent adhesive colored in accordance with NFPA 99 Table 5.1.11 and shall be visible on all sides of the pipe. Pipe labels shall be BeaconMedaes Series 6-435.

11. Alarms and valves shall be labeled for gas service and areas monitored or controlled. Coordinate with owner for final room or area designations. Label valves with name and identification color of the gas and direction of flow.

12. Piping penetrating an electromagnetic shield shall have an isolation device on each side of shield.

C. Labeling

1. Label the medical gas pipelines per NFPA 99 5.1.11 and as follows:

a. Label each master alarm signal for function after ring out.

b. Label each zone valve and area alarm for the area of control or surveillance after test.

2. Labels shall be permanent and of a type approved by the owner. Owner will specify approved bar codes, wall placards and pipe labeling.
3.2 INSTALLER TESTING

A. Prior to declaring the lines ready for final verification, the installing contractor shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.2 and attest in writing;

1. That all brazing was conducted by brazers qualified to ASSE 6010 and holding current medical gas endorsements.

2. That all brazing was conducted with nitrogen NF purging. (Procedure per NFPA 99 5.1.10.5.5). Nitrogen cylinder must have a low contents alarm.

3. That the lines have been blown clear of any construction debris using oil free dry nitrogen or air are clean and ready for use. (Procedure per NFPA 99 5.1.12.2.2). An oxygen analyzer must be used to verify concentration when brazing at all times.

4. That the assembled piping, prior to the installation of any devices, maintained a test pressure 1 1/2 times the standard pressures listed in NFPA 99 Table 5.1.11 without leaks. (Procedure per NFPA 99 5.1.12.2.3).

5. That after installation of all devices, the pipeline was proven leak free for 24 hours at a pressure 20% above the standard pressures listed in NFPA 99 Table 5.1.11. (Procedure per NFPA 99 5.1.12.2.6)

6. That the systems have been checked for cross connections and none were found. (Procedure per NFPA 99 5.1.12.2.4)

7. That the manufacturer has started up all medical air compressors, medical vacuum pumps WAGD producers, liquid oxygen system(s) and manifolds, and that they are in operating order.

8. The Contractor shall furnish documentation attesting that all installed piping materials were purchased cleaned and plugged or capped in accordance with the requirements of NFPA 99 5.1.10.1 and 5.1.10.2. Contractor must also provide Certificates of Conformance indicating that all piping materials meet the metallurgical specifications set forth in ASTM B819.

9. Installer shall provide installers report and piping certificates prior to tie in.
10. All new piping shall be tested for particulate and purity, one (1) week prior to tie in by CHT using Nitrogen NF.

11. All labeling and alarm wiring must be completed prior to verification.

B. Provide four originals of the affidavit, distributed; (1) to the engineer, (1) to the owners representative, (1) to the general contractor and (1) to the verifier.

3.3 VERIFIER TESTING

A. Prior to handing over the systems to the owner, contractor shall retain CHT (216-255-9607), who shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.3 and provide a written report and certificate which contains at least the following:

1. A current ACORD insurance certificate indicating professional liability coverage in the minimum amount of $1 Million per occurrence, and general aggregate liability in the minimum amount of $1 Million, valid and in force when the project is to be verified. General liability insurance is not alone acceptable.

2. A listing of all tests performed, listing each source, outlet, valve and alarm included in the testing.

3. A statement that equipment used was calibrated at least within the last six months by a method traceable to a National Bureau of Standard Reference and enclosing certificates or other evidence of such calibration(s). Where outside laboratories are used in lieu of on site equipment, those laboratories shall be named and their original reports enclosed.

4. A statement that where and when needed, equipment was re-calibrated during the verification process and describing the method(s) used.

5. A statement that the systems were tested and found to be free of debris to a procedure per NFPA 99 5.1.12.3.7.

6. The flow from each outlet when tested to a procedure per NFPA 99-5.1.12.3.10.

7. A statement that the systems were tested and found to have no cross-connections to a procedure per NFPA 99 5.1.12.3.3.

8. A statement that the systems were tested and found to be free of contaminants to a
procedure per NFPA 99 5.1.12.3.8 except that the purity standard shall be 2 ppm difference for halogenated hydrocarbons and 1 ppm total hydrocarbons (as methane).

9. A statement that all local signals function as required under NFPA 99 5.1.3.4.7 and as per the relevant NFPA 99 sections relating to the sources.

10. A listing of local alarms, their function and activation per NFPA 99 5.1.12.3.14.

11. A listing of master alarms, their function and activation, including pressures for high and low alarms per NFPA 99 5.1.12.3.5.2.

12. A listing of area alarms, their function and activation pressures per NFPA 99 5.1.12.3.5.3.

13. A statement that the sources include all alarms required by NFPA 99 Table A.5.1.9.5.

14. The concentration of each component of NFPA 99 Table 5.1.12.3.12 in the medical air after 24 hours of operation of the medical air source.

15. The concentration of each gas at each outlet as specified in NFPA 99 5.1.12.3.11.

16. A statement that all valves and alarms are accurately labeled as to zone of control.

B. Provide four originals of this affidavit, and report, distributed; (1) to the engineer, (1) to the owner’s representative, (1) to the general contractor and (1) to the installing contractor.

SPECIAL NOTES:

1. All permits are the responsibility of Contractor; State, Local and Cleveland Clinic, as needed.

2. System shutdowns of the Medical gases shall be arranged with CHT (216-255-9607) and Cleveland Clinic. All shutdowns shall be scheduled one week in advance and use documentation in ASSE 6000, Annex J.

3. Contractor will be responsible for determining shutdown schedule and coordinating with CHT for verification and Cleveland Clinic respiratory for interruption of service.

4. All parties (Construction, Engineering, Facilities and CHT) must approve the Medical gas shutdown procedure before maintenance schedules the field work.

5. CHT must review all drawings containing Medical gases prior to construction and verify any required changes are made before drawings are issued.
6. All service valves, if available, shall have dual ports for purging and verification testing.

7. All medical arms and pendants shall have self-contained braking systems.

END OF SECTION 226000
SECTION 226600 - CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

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:

2. Double-containment piping.
3. Field-fabrication containment piping.
4. Piping specialties.
5. Neutralization tanks.
6. Neutralization systems.
7. Manholes.
8. Leak-detection systems.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. FPM: Vinylidene fluoride-hexafluoro propylene copolymer rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Single-Wall Piping Pressure Rating: 10 feet head of water (30 kPa).

B. Double-Containment Piping Pressure Rating:

1. Carrier Piping: 5-psig (34.5-kPa) air test pressure.
2. Containment Piping: 5-psig (34.5-kPa) air test pressure.

C. Field-Fabrication Containment-Piping Pressure Rating: 5-psig (34.5-kPa) air test pressure.

D. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
1.5 Action Submittals

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

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Shop Drawings: For neutralization system and leak-detection system. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail neutralization-system assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Detail leak-detection-system assemblies and indicate required clearances, method of field assembly, components, and location and size of each field connection.
   3. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated-Design Submittal: For seismic restraints of aboveground piping, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 Informational Submittals

A. Profile Drawings for Outdoor Underground Piping: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate underground structures and pipes. Show types, sizes, materials, and elevations of other utilities crossing system piping.

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

C. Field quality-control test reports.

1.7 Closeout Submittals

A. Operation and Maintenance Data: For chemical-waste specialties and [neutralization tanks,] [neutralization systems,] [and] [leak-detection systems] to include in emergency, operation, and maintenance manuals.

1.8 Maintenance Material Submittals

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Neutralization-Tank Limestone: Equal to 200 percent of amount required for each tank sump initial charge. Furnish limestone in 50-lb (22.7-kg) bags.
2. Neutralization-System Limestone and Chemicals: For each neutralization system.
   a. Limestone: Equal to 500 percent of amount required for tank sump initial charge.
      Furnish limestone in 50-lb (22.7-kg) bags.
   b. Chemicals: Equal to [500] [1000] percent of neutralizing chemicals required for
      filling tanks.

1.9 QUALITY ASSURANCE

[Retain this article for neutralization systems or leak-detection systems.]

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. NFPA Compliance: Comply with NFPA 70, "National Electrical Code."

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, fittings, and seals from dirt and damage.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Chemical-Waste Service: Do not interrupt chemical-waste service to
   facilities occupied by Cleveland Clinic or others unless permitted under the following
   conditions and then only after arranging to provide temporary chemical-waste service according
   to requirements indicated:

   1. Notify Construction Manager and Cleveland Clinic Plumbing Supervisor no fewer than
      seven days in advance of proposed interruption of chemical-waste service.
   2. Do not proceed with interruption of chemical-waste service without Cleveland Clinic
      Plumbing Supervisor's written permission.

1.12 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-
   bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in
   [Section 033000 "Cast-in-Place Concrete." ] [Section 033053 "Miscellaneous Cast-in-Place
   Concrete." ]
PART 2 - PRODUCTS

2.1 SINGLE-WALL PIPE AND FITTINGS

A. PE Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ISCO Industries, LLC.
   b. Performance Pipe; a division of Chevron Phillips Chemical Company LLC.


B. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with [fusion] [fusion-and-mechanical] [mechanical]-joint ends.

1. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. IPEX Inc.
   b. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
   c. Sloane, George Fischer Inc.
   d. Town & Country Plastics, Inc.
   e. Watts Industries (Canada) Inc.
   f. Zurn Plumbing Products Group; Chemical Drainage Systems.

C. PVC Drainage Pipe and Fittings: ASTM D 2665, pipe and drainage-pattern fittings.

D. PVDF Drainage Pipe and Fittings: ASTM F 1673, Schedule 40, pipe and drainage-pattern fittings. Include fittings with [fusion] [fusion-and-mechanical] [mechanical]-joint ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
   b. Watts Industries (Canada) Inc.
   c. Zurn Plumbing Products Group; Chemical Drainage Systems.

E. Fiberglass Pipe and Fittings, Centrifugally Cast: ASTM D 2997, Type II, [Grade 1] [Grade 2], [Class A] [Class B] [Class C], RTRP pipe; with ASTM D 5685, Type 4, RTRF fittings matching pipe; and [adhesive-bonding] [adhesive-bonding and butt-and-wrap-joint] [butt-and-wrap-joint] materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.
1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
   a. **Smith Fibercast**.

F. Fiberglass Pipe and Fittings, Filament Wound: ASTM D 2996, Type I, [Grade 1] [Grade 2], [Class A] [Class B] [Class C] [Class E] [Class F], RTRP pipe; ASTM D 5685, Type 1, RTRF fittings matching pipe; and [adhesive-bonding] [adhesive-bonding and butt-and-wrap-joint] [butt-and-wrap-joint] materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
   a. **Ameron International; Fiberglass Pipe Group**.
   b. **Fibrex**.
   c. **Smith Fibercast**.

G. High-Silicon-Iron, Hub-and-Plain-End Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; acid-resistant packing; and lead caulking materials.

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
   a. **Flowserve Corporation; Foundry Operations**.

H. High-Silicon-Iron, Mechanical-Joint Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; and stainless-steel clamps with TFE inner sleeve and CR outer sleeve.

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
   a. **Flowserve Corporation; Foundry Operations**.

I. Stainless-Steel Drainage Pipe and Fittings: ASME A112.3.1, ASTM A 666, Type 316L, stainless-steel pipe and drainage-pattern fittings; with socket and spigot ends for gasket joints; and having piping manufacturer's FPM lip-seal rubber gaskets shaped to fit socket groove, with plastic backup ring.

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
   a. **Josam Company; Blucher-Josam Div**.

J. Borosilicate Glass Pipe and Fittings: ASTM C 1053, pipe and drainage-pattern fittings; with manufacturer's standard couplings.

1. **Covering**: Factory-applied polystyrene for pipe installed underground.

2. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
K. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.

2.2 DOUBLE-CONTAINMENT PIPE AND FITTINGS

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

1. Ameron International; Fiberglass Pipe Group.
2. Asahi/America.
3. Eslon Thermoplastics; Guardian Div.
4. Fischer, George Inc.
5. Flo Safe, Inc.
7. IPEX Inc.
8. IPEX Inc.; Guardian Div.
9. NIBCO INC.
10. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
11. Performance Pipe; a division of Chevron Phillips Chemical Company LLC.
12. Rovanco Piping Systems, Inc.
14. Thermcor Process, L.P.

B. Description: Factory-fabricated, double-wall pipe and fittings. Sizes indicate carrier-pipe size; with carrier (inner) pipe and fittings; annular-space, carrier-pipe supports; containment (outer) pipe and fittings; and joining materials and fasteners. Include manufacturer's standard piping materials according to the following:

1. PE, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.


3. PP/PVC, Double-Containment Drainage Pipe and Fittings:
   c. PVC Containment Pipe: ASTM D 2665, PVC pipe.
   d. PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.
   
   b. Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311.

5. PVDF/PVC, Double-Containment Drainage Pipe and Fittings:
   
a. PVDF Carrier Pipe: ASTM F 1673, Schedule 40; made of ASTM D 3222, PVDF resin.
   b. PVDF Carrier-Pipe Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311; made of ASTM D 3222, PVDF resin.
   c. PVC Containment Pipe: ASTM D 2665, PVC pipe.
   d. PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.

C. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

2.3 FIELD-FABRICATION CONTAINMENT PIPING

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

1. Flo Safe, Inc.
2. Sloane, George Fischer Inc.

B. Description: Containment split pipe and split fittings with carrier-pipe centralizers. Include manufacturer's fastening devices and materials.

1. Material: [HDPE] [PP] [Yellow PVC] [Clear PVC] pipe and fittings.
2. Fastening System: FPM gaskets, clamps, and pins.
3. Material: Clear PVC pipe and fittings with adhesive channels, for use with drainage-pattern carrier piping.

2.4 JOINING MATERIALS

A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.
D. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Fiberglass-Pipe Adhesive: As furnished or recommended by pipe manufacturer.

1. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 PIPING SPECIALTIES

A. Plastic Dilution Traps:

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

   a. IPEX Inc.
   b. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
   c. Sloane, George Fischer Inc.
   d. Town & Country Plastics, Inc.

3. End Connections: Mechanical joint.
4. Dilution Tanks: 1-gal. (3.8-L) capacity, with clear base unless colored base is indicated; with two NPS 1-1/2 (DN 40) top inlets and one NPS 1-1/2 (DN 40) side outlet.
5. Small Dilution Jars: 1-pint (0.5-L) capacity, with clear base unless colored base is indicated; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.
6. Large Dilution Jars: 1-quart (1-L) capacity; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.

B. High-Silicon-Iron Dilution Traps:

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

   a. Flowserve Corporation; Foundry Operations.

3. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50) as required for fixture and waste.
4. End Connections: Mechanical.

C. Glass, Drain-Line, Interceptor Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. **SCHOTT Corporation.**

3. Type: Drum trap.
4. Size: NPS 1-1/2 (DN 40), NPS 2 by NPS 1-1/2 (DN 50 by DN 40), or NPS 2 (DN 50), as required to match connecting piping.

D. Corrosion-Resistant Traps:

1. Type: P-trap or drum trap.
2. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50), as required to match connected piping.
3. High-Silicon Iron: ASTM A 861, with horizontal outlet and hub-and-plain or plain ends to match connecting piping.
4. PP: ASTM D 4101, with mechanical-joint pipe connections.
5. PVDF: ASTM D 3222, with mechanical-joint pipe connections.

E. High-Silicon-Iron Floor Drains **<Insert drawing designation>:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **Flowserve Corporation; Foundry Operations.**
3. Body: With integral flashing flange and weep holes; and with [flashing ring and stainless-steel strip] [sediment basin] [and] [funnel attachment].
4. Top: 8-3/4-inch (222-mm) diameter with grate.
5. Size: NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.

F. Stainless-Steel Floor Drains **<Insert drawing designation>:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **Josam Company; Blucher-Josam Div.**
2. Standard: ASME A112.3.1, ASTM A 666, Type 316L.
4. Outlet: Bottom, of size indicated.

G. PP Floor Drains **<Insert drawing designation>:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. **IPEX Inc.**
   b. **Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.**
   c. **Schier Products Company.**
d. Sloane, George Fischer Inc.
e. Town & Country Plastics, Inc.
f. Watts Industries (Canada) Inc.

2. Body: With 7- to 9-inch (178- to 230-mm) top diameter, with flashing flange and weep holes; and with [flashing clamp] [basket strainer] [funnel attachment] [and] [trap-primer connection].

3. Outlet: Bottom, to match connecting pipe, with NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.

H. High-Silicon-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flowserve Corporation; Foundry Operations.

2. Standard: ASTM A 861, fitting with PTFE gasket and closure plug, of design appropriate for piping application.

I. Stainless-Steel Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.3.1, ASTM A 666, Type 316L, stainless steel.
3. Aboveground Piping: Cleanout tee of size matching piping.

J. High-Silicon-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flowserve Corporation; Foundry Operations.

3. Body: Hub-and-plain end with swing-check valve[; and with high-silicon-iron pipe extension of length to reach floor surface, and high-silicon-iron closure plug.]

K. Plastic Backwater Valves:

1. Description: Full-port NPS 3 (DN 80) check valve, PP or PVDF, matching or compatible with system piping and compatible with system liquid, with EPDM seals and flanged ends.
   a. Exception: PVC material for use with PVC piping systems.

L. High-Silicon-Iron Sink Outlets:
1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. Flowserve Corporation; Foundry Operations.

2. Standard: ASTM A 861, high-silicon iron, NPS 1-1/2 (DN 40), with clamping device and 4-, 6-, or 8-inch- (100-, 150-, or 200-mm-) high overflow fitting, as indicated.

### M. PP Sink Outlets:

1. Description: NPS 1-1/2 (DN 40), with clamping device, stopper, and 7-inch- (178-mm-) high overflow fitting.

### N. Glass Sink Outlets:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. SCHOTT Corporation.

2. Standard: ASTM C 1053, components for field assembly, NPS 1-1/2 (DN 40); with sink assembly of outlet, strainer, gasket, and locknut; overflow fitting of length indicated; and tailpiece assembly of borosilicate glass and locknut.

### 2.6 NEUTRALIZATION TANKS

#### A. Plastic Neutralization Tanks [Insert drawing designation]:

1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   a. Chem-Tainer Industries.
   b. IPEX Inc.
   c. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
   d. Schier Products Company.
   e. Sloane, George Fischer Inc.
   f. Town & Country Plastics, Inc.
   g. Watts Industries (Canada) Inc.

2. Description: Corrosion-resistant plastic materials; with removable, gastight cover; interior, sidewall, dip-tube inlet; outlet; vent; and threaded or flanged, sidewall pipe connections.
   a. Material: [HDPE], [HDPE or ASTM D 4101, PP], [ASTM D 4101, PP].
   b. Tank Capacity: [Insert capacity].
   c. Dip Tube: On outlet pipe instead of inlet pipe.
   d. Extension: HDPE, PE, or PP.
   e. Traffic Cover: [Light-duty], [Heavy-duty pedestrian or light-duty vehicular, steel plate over] plastic, bolted.
f. Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
g. Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

B. Ceramic Neutralization Tanks *(Insert drawing designation)*:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Koch Knight LLC.

2. Description: Corrosion-resistant, cast-ceramic shell; with removable, reinforced-plastic, gastight cover; inlet; interior, sidewall, dip-tube outlet; vent; and bell, sidewall pipe connections.
   a. Tank Capacity: *(Insert capacity)*.
   b. Extension: Ceramic, of size and length indicated, and with cast-iron manhole frame and cover.
   c. *(Retain one of two subparagraphs below. Retain second for chemical wastes with high sulfuric acid content.)*
   d. Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
   e. Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

C. Collection Tanks: Corrosion-resistant, cast-ceramic shell. Include removable, reinforced-plastic, gastight cover; inlet; vent; and bell, sidewall pipe connections.

1. Extension: *(Ceramic) [Steel with protective coating]*, 28-inch (710-mm) minimum diameter, and cast-iron manhole frame and cover.

2.7 NEUTRALIZATION SYSTEMS

A. Plastic-Tank Neutralization Systems *(Insert drawing designation)*:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
   b. Town & Country Plastics, Inc.

2. Description: Automatic system for neutralizing chemical waste.
   a. Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.
b. Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, but not less than the following:

1) Power light and on/off switch.
2) pH analyzer with meter and high- and low-pH indicators.
3) Low caustic- and acid-solution level indicators.
4) Alarm horn with silencer and reset switch.
5) Agitator running light with on/off switch.
6) Running lights with on/off switches for caustic- and acid-solution pumps.

c. Strip chart recorder with capacity for 30-day record.
d. Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.
e. Interceptor Tank: Same material as mixing tank; with removable, gastight cover; and sidewall inlet and outlet piping connections.
f. Neutralization Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and vent connection in sidewall or top.

[Retain one of first two subparagraphs below. Retain second for chemical wastes with high sulfuric acid content.]

1) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
2) Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

g. Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping connections; vent connection in sidewall or top; neutralizing-solution piping connections; and openings in top for probe and agitator.

1) Material: [HDPE] [HDPE or ASTM D 4101, PP] [ASTM D 4101, PP].
2) pH Probe: Type and length suitable for mixing-tank size.
3) Agitator: Electric, with stainless-steel shaft and propeller.

h. Caustic-Solution Storage Tank: PP.

1) Caustic Chemical: Sodium hydroxide solution.

i. Acid Storage Tank: PP.

1) Acid Chemical: Sulfuric acid solution.

j. Metering Pumps: Types suitable for neutralizing solutions.
k. Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.

1) pH probe: Type and length suitable for sampling-tank size.

B. Ceramic-Tank Neutralization Systems <Insert drawing designation>: 
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Koch Knight LLC.

2. Description: Automatic system for neutralizing chemical waste.
   a. Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves,
      and metering pumps and to monitor pH of effluent; with wiring and electrical-
      power terminals.
   b. Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with
      manufacturer's standard features, control devices, and indicators, including the
      following:
      1) Power light and on/off switch.
      2) pH analyzer with meter and high- and low-pH indicators.
      3) Low caustic- and acid-solution level indicators.
      4) Alarm horn with silencer and reset switch.
      5) Agitator running light with on/off switch.
      6) Running lights with on/off switches for caustic- and acid-solution pumps.
   c. Strip chart recorder with capacity for 30-day record.
   d. Piping between Tanks: Same material as chemical-waste piping system unless
      otherwise indicated.
   e. Interceptor Tank: Same material as mixing tank; with removable, gastight cover;
      and sidewall inlet and outlet piping connections.
   f. Neutralization Tank: Same material as mixing tank; with removable, gastight
      cover; sidewall inlet and outlet piping connections; and vent connection in sidewall
      or top.
      [Retain one of first two subparagraphs below. Retain second for chemical
      wastes with high sulfuric acid content.]
      1) Limestone: Chips or lumps, with more than 90 percent calcium carbonate
         content and 1- to 3-inch (25- to 75-mm) diameter.
      2) Dolomitic Limestone: Chips or lumps, with more than 90 percent combined
         magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to
         75-mm) diameter.
   g. Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping
      connections; vent connection in sidewall or top; neutralizing-solution piping
      connections; and openings in top for probe and agitator.
      1) Material: Clay, vitrified into ceramic unit.
      2) pH Probe: Type and length suitable for mixing tank size.
      3) Agitator: Electric, with stainless-steel shaft and propeller.
   h. Caustic-Solution Storage Tank: PP.
      1) Caustic Chemical: Sodium hydroxide solution.
   i. Acid Storage Tank: PP.
1) Acid Chemical: Sulfuric acid solution.

j. Metering Pumps: Types suitable for neutralizing solutions.

k. Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.

1) pH probe: Type and length suitable for sampling-tank size.

2.8 MANHOLES

A. Description: ASTM F 1759, fabricated from PE components. Include bottom, sidewalls, and top sections; corrosion-resistant, manhole frame and cover; fusion or other watertight joints; and design to prohibit flotation.

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

   a. Ayer Sales, Inc.
   b. ISCO Industries, LLC.
   c. Performance Pipe; a division of Chevron Phillips Chemical Company LLC.
   d. Plastic Fusion Fabricators, Inc.

2. Construction: [Single wall] [Double wall with interstitial space].


4. Connections: Inlets and outlet matching or suitable for piping.

5. Steps: Manufacturer's standard, fusion welded to sidewall. Omit steps for manholes less than 60 inches (1500 mm) deep.

6. Top: Include 24-inch- (610-mm-) nominal-diameter frame and cover.

2.9 LEAK-DETECTION SYSTEMS

A. Leak-Detection Systems <Insert drawing designation>:  

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

   a. Asahi/America.
   b. Flo Safe, Inc.
   c. Perma-Pipe, Inc.; Subsidiary of MFRI, Inc.
   d. Tyco Thermal Controls LLC; Tracer Div.

2. Description: Cable leak-detection system capable of detecting and annunciating fluid leaks; with controls, panel, wiring, cable sensors, probes if required, and piping.

   a. Annunciator Panel: Enclosure with visual and audible alarms and leak location indicator.
b. Sensors: Electric cable, suitable for insertion into double-containment piping annular space, with capability of detecting fluid leaks and signaling locations of leaks.

PART 3 - EXECUTION

3.1 EARTHWORK

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

3.2 CONCRETE BASES

A. Anchor [neutralization tanks] [and] [neutralization system tanks] to concrete bases.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch (480-mm) centers around full perimeter of base.
   2. For installed 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 imbedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in [Section 033000 "Cast-in-Place Concrete." ] [Section 033053 "Miscellaneous Cast-in-Place Concrete." ]
   7. Comply with requirements in [Section 033000 "Cast-in-Place Concrete"] [Section 033053 "Miscellaneous Cast-in-Place Concrete"] for cast-in-place concrete materials and placement.

3.3 PIPING INSTALLATION

A. Chemical-Waste Sewerage Outside the Building:
   1. Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground chemical-waste sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
   2. 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.
   3. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
4. 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.

5. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

6. Install drainage piping pitched down in direction of flow, at minimum slope of $\frac{1}{2}$ percent, unless otherwise indicated.

7. Install drainage piping with $36$-inch (915-mm) $48$-inch (1220-mm) $60$-inch (1524-mm) $72$-inch (1830-mm) minimum cover.

8. Install PE drainage piping according to ASTM D 2321 and ASTM F 1668.

9. Install PVC drainage piping according to ASTM D 2321 and ASTM F 1668.

10. Install PVDF drainage piping according to ASTM D 2321 and ASTM F 1668.

11. Install fiberglass piping according to ASTM D 3839 and ASTM F 1668.

12. Install field-fabrication containment piping over new and existing carrier piping. Use containment piping manufacturer's fastening system.

13. Clear interior of piping and structures 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.

B. Chemical-Waste Piping Inside the Building:

1. Install piping next to equipment, accessories, and specialties to allow service and maintenance.

2. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.

3. Flanges may be used on aboveground piping unless otherwise indicated.

4. Install underground fiberglass piping according to ASTM D 3839.

5. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

6. 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.

7. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

8. Install piping at indicated slopes.

9. Install piping free of sags and bends.

10. Install fittings for changes in direction and branch connections.

11. Verify final equipment locations for roughing-in.

12. 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."

13. 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."

3.4 PIPING SPECIALTY INSTALLATION

A. Embed floor drains in 4-inch (100-mm) minimum depth of concrete around bottom and sides. Comply with requirements in [Section 033000 "Cast-in-Place Concrete"] [Section 033053 "Miscellaneous Cast-in-Place Concrete"] for concrete.

B. Fasten grates to drains if indicated.

C. Set floor drains with tops flush with pavement surface.

D. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use fittings of same material as sewer pipe at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

   1. Set cleanout bodies in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade. Set cleanout plugs in concrete pavement with tops flush with pavement surface. Comply with requirements in [Section 033000 "Cast-in-Place Concrete"] [Section 033053 "Miscellaneous Cast-in-Place Concrete"] for formwork, reinforcement, and concrete requirements.

E. Install backwater valves in horizontal position. Include riser to cleanout at grade.

3.5 JOINT CONSTRUCTION

A. Chemical-Waste Sewerage Outside the Building:

   1. Plastic-Piping, Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
   2. Make fiberglass-piping bonded joints according to ASTM D 3839.
   4. Join dissimilar pipe materials with adapters compatible with pipe materials being joined.
   5. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
   7. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

B. Chemical-Waste Piping Inside the Building:

   1. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
   2. Fiberglass-Piping Joints: Make joints with piping manufacturer's bonded adhesive.
   3. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.
   5. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
   6. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.
3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe sizes in this article refer to aboveground, single-wall piping and carrier piping of containment piping.

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

C. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

D. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for installation of supports.

E. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

F. Support vertical piping and tubing at base and at each floor.

G. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch (10 mm).

H. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50): 33 inches (840 mm) with 3/8-inch (10-mm) rod.
2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 (DN 200): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.

I. Install supports for vertical PP piping every 72 inches (1830 mm).

J. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 42 inches (1067 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.

K. Install supports for vertical PVC piping every 48 inches (1220 mm).

L. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:
   1. All Sizes: Install continuous support for piping with liquid waste at temperatures above 140 deg F (60 deg C).
   2. NPS 1/2 (DN 15) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
   3. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
   4. NPS 2 (DN 50): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
   5. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
   6. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
   7. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.

M. Install supports for vertical PVDF piping NPS 1-1/2 (DN 40) every 48 inches (1220 mm) and NPS 2 (DN 50) and larger every 72 inches (1830 mm).

N. Install vinyl-coated hangers for fiberglass piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2 (DN 50) and Smaller: 10 feet (3 m) with 3/8-inch (10-mm) rod.
   2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 10 feet (3 m) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 10 feet (3 m) with 5/8-inch (16-mm) rod.
   4. NPS 6 (DN 150): 10 feet (3 m) with 3/4-inch (19-mm) rod.
   5. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.6 m) with 7/8-inch (22-mm) rod.

O. Install supports for vertical fiberglass piping every 12 feet (3.6 m).

P. Install hangers for stainless-steel drainage piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
   2. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
   3. NPS 3 (DN 80): 12 feet (3.6 m) with 1/2-inch (13-mm) rod.
   4. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.6 m) with 5/8-inch (16-mm) rod.
   5. NPS 6 (DN 150): 12 feet (3.6 m) with 3/4-inch (19-mm) rod.

Q. Install supports for vertical stainless-steel drainage piping every 15 feet (4.5 m).
R. Install hangers for high-silicon-iron piping with the following maximum horizontal spacing and minimum rod diameters:

1. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50):** 60 inches (1520 mm) with 3/8-inch (10-mm) rod.
2. **NPS 3 (DN 80):** 60 inches (1520 mm) with 1/2-inch (13-mm) rod.
3. **NPS 4 and NPS 5 (DN 100 and DN 125):** 60 inches (1520 mm) with 5/8-inch (16-mm) rod.
4. **NPS 6 (DN 150):** 60 inches (1520 mm) with 3/4-inch (19-mm) rod.
5. **NPS 8 to NPS 12 (DN 200 to DN 300):** 60 inches (1520 mm) with 7/8-inch (22-mm) rod.
6. **NPS 15 (DN 375):** 60 inches (1520 mm) with 1-inch (25-mm) rod.
7. Spacing for horizontal pipe in 84-inch (2134-mm) lengths may be increased to 84 inches (2134 mm). Spacing for fittings is limited to 60 inches (1520 mm).

S. Install supports for vertical high-silicon-iron piping every 15 feet (4.5 m).

T. Install vinyl-coated hangers for glass piping with the following maximum horizontal spacing and minimum rod diameters:

1. **NPS 1 and NPS 1-1/4 (DN 25 and DN 32):** 72 inches (1830 mm) with 3/8-inch (10-mm) rod.
2. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50):** 96 inches (2440 mm) with 3/8-inch (10-mm) rod.
3. **NPS 3 (DN 80):** 96 inches (2440 mm) with 1/2-inch (13-mm) rod.
4. **NPS 4 and NPS 6 (DN 100 and DN 150):** 96 inches (2440 mm) with 5/8-inch (16-mm) rod.

U. Install supports for vertical glass piping every 96 inches (2440 mm).

V. Support piping and tubing not listed above according to MSS SP-69.

### 3.7 NEUTRALIZATION TANK INSTALLATION

A. Install exterior [collection] [collection and neutralization] [neutralization] tanks, complete with appurtenances indicated.

1. Set tops of tank covers flush with finished surface where covers occur in pavements. Set covers 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
2. Include initial fill of limestone for neutralization tanks.

B. Install interior neutralization tanks on smooth and level [concrete base] [floor surface]. Include full initial charge of limestone.

### 3.8 NEUTRALIZATION SYSTEM INSTALLATION

A. Install neutralization systems on smooth and level [concrete base] [floor surface]. Include neutralizing solutions and full initial charge of limestone.
3.9 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated. Comply with requirements in Section 221313 "Facility Sanitary Sewers."

B. Set tops of manhole frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.10 LEAK-DETECTION SYSTEM INSTALLATION


B. Double-Containment Piping: Install leak-detection system in piping annular space.

C. Manholes: Install leak-detection system around bottom of exterior.

D. Install panel in location indicated.

3.11 CONCRETE PLACEMENT

A. Comply with requirements in [Section 033000 "Cast-in-Place Concrete"] [Section 033053 "Miscellaneous Cast-in-Place Concrete"] for concrete supports.

B. Place cast-in-place concrete according to ACI 318/318R.

3.12 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make connections to existing piping so finished Work complies as nearly as practical with requirements specified for new Work.

C. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

D. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.

E. Install piping adjacent to equipment to allow service and maintenance.

3.13 LABELING AND IDENTIFICATION

A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for labeling of equipment and piping.
1. Use [warning tape or] detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place and again at completion of Project.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between inspection points.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Hydrostatic Tests for Drainage Piping:
      1) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/mm of nominal pipe size per kilometer) of pipe, during 24-hour period.
      2) Close openings in system and fill with water.
      3) Purge air and refill with water.
      4) Disconnect water supply.
      5) Test and inspect joints for leaks.
   e. Air Tests for Drainage Piping: Comply with UNI-B-6.

2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Submit separate reports for each test.

B. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Tests and Inspections:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect assembled [neutralization systems] [and] [leak-detection systems] and their installation, including piping and electrical connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Chemical-waste piping will be considered defective if it does not pass tests and inspections.
F. Prepare test and inspection reports.

3.15 STARTUP SERVICE

A. [Engage a factory-authorized service representative to perform] [Perform] startup service for [neutralization systems] [and] [leak-detection systems].

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Neutralization Systems:
   a. Verify that neutralization system is installed and connected according to the Contract Documents.
   b. Verify that electrical wiring installation complies with manufacturer's submittal.
   c. Install neutralizing solutions and limestone.
   d. Energize circuits.
   e. Start and run systems through complete sequence of operations.
   f. Adjust operating controls.

3. Leak-Detection Systems:
   a. Verify that electrical wiring installation complies with manufacturer's submittal.
   b. Energize circuits.
   c. Adjust operating controls.

3.16 ADJUSTING

A. Adjust neutralization-system set points.

B. Adjust leak-detection-system control and device settings.

3.17 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with potable water.

3.18 DEMONSTRATION

A. Engage a factory-authorized service representative to train Cleveland Clinic maintenance personnel to adjust, operate, and maintain [neutralization systems] [and] [leak-detection systems].
3.19 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.

B. Single-Wall, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:

1. NPS 2 to NPS 4 (DN 50 to DN 100): [High-silicon-iron, hub-and-plain-end pipe and fittings and calked] [High-silicon-iron, mechanical-joint pipe and fittings and coupled] joints.
2. NPS 2 to NPS 4 (DN 50 to DN 100): Stainless-steel drainage pipe and fittings and gasketed joints.
3. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PE drainage pipe and fittings and heat-fusion joints.
4. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PP drainage pipe and fittings and electrofusion joints.
5. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVC drainage pipe and fittings and solvent-cemented joints.
6. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVDF drainage pipe and fittings and electrofusion joints.
7. NPS 2 to NPS 4 (DN 50 to DN 100): [Centrifugally cast] [Filament-wound] fiberglass pipe and fittings and [butt-and-wrap] [bonded] joints.
8. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): Glass pipe and fittings and coupled joints.
10. NPS 6 (DN 150): Stainless-steel drainage pipe and fittings and gasketed joints.
11. NPS 6 (DN 150): PE drainage pipe and fittings and heat-fusion joints.
12. NPS 6 (DN 150): PP drainage pipe and fittings and electrofusion joints.
13. NPS 6 (DN 150): PVC drainage pipe and fittings and solvent-cemented joints.
14. NPS 6 (DN 150): PVDF drainage pipe and fittings and electrofusion joints.
15. NPS 6 (DN 150): [Centrifugally cast] [Filament-wound] fiberglass pipe and fittings and [butt-and-wrap] [bonded] joints.
17. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron, hub-and-plain-end pipe and fittings and calked joints.
18. NPS 8 to NPS 12 (DN 200 to DN 300): PP drainage pipe and fittings and electrofusion joints.
19. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
20. NPS 8 to NPS 12 (DN 200 to DN 300): PVDF drainage pipe and fittings and electrofusion joints.
21. NPS 8 to NPS 12 (DN 200 to DN 300): [Centrifugally cast] [Filament-wound] fiberglass pipe and fittings and [butt-and-wrap] [bonded] joints.

C. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:
1. NPS 2 to NPS 12 (DN 50 to DN 300): PE double-containment drainage pipe and fittings.
2. NPS 2 to NPS 12 (DN 50 to DN 300): PP double-containment drainage pipe and fittings.
3. NPS 2 to NPS 12 (DN 50 to DN 300): PP/PVC double-containment drainage pipe and fittings.
4. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF double-containment drainage pipe and fittings.
5. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF/PVC double-containment drainage pipe and fittings.

D. Aboveground Chemical-Waste Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and [electrofusion] [mechanical] joints.
2. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
3. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and [electrofusion] [mechanical] joints.
4. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion joints.
5. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): High-silicon-iron piping with hub-and-plain ends and calked joints.
6. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.
7. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass pipe and fittings, couplings, and coupled joints.
8. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
9. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron piping with hub-and-plain ends and calked joints.

E. Under Slab-on-Grade, Indoor, Chemical-Waste Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and [electrofusion] joints.
2. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
3. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion joints.
4. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) high-silicon-iron piping with hub-and-plain ends and calked joints.
5. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.
6. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass piping with covering, couplings, and coupled joints.
7. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PE [PP] [PP/PVC] [PVDF] [PVDF/PVC], double-containment drainage piping and manufacturer's standard joints.
8. NPS 8 (DN 200): PVC drainage piping and solvent-cemented joints.
10. NPS 8 (DN 200): PE [PP] [PP/PVC] [PVDF] [PVDF/PVC], double-containment drainage piping and manufacturer's standard joints.
11. **NPS 10 and NPS 12 (DN 250 and DN 300):** PVC drainage piping and solvent-cemented joints.

12. **NPS 10 to NPS 15 (DN 250 to DN 375):** High-silicon-iron piping with hub-and-plain ends and caulked joints.

END OF SECTION 226600
SECTION 226700 - PROCESSED WATER SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

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 [reagent-water] [deionized-water] [distilled-water] [and] [reverse-osmosis-water] piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings:

[Retain first subparagraph below if all piping will be the same material, and delete "Deionized-Water Piping," "Distilled-Water Piping," and "Reverse-Osmosis-Water Piping" subparagraphs.]

1. Reagent-Water Piping: [20 psig (138 kPa)] [40 psig (276 kPa)] [50 psig (345 kPa)] [100 psig (690 kPa)] unless otherwise indicated.

[Retain one or more of three subparagraphs below for specific reagent-water piping systems, and delete "Reagent-Water Piping" Subparagraph above.]

2. Deionized-Water Piping: [50 psig (345 kPa)] [100 psig (690 kPa)] [150 psig (1035 kPa)] unless otherwise indicated.

3. Distilled-Water Piping: [50 psig (345 kPa)] [100 psig (690 kPa)] [150 psig (1035 kPa)] unless otherwise indicated.

4. Reverse-Osmosis-Water Piping: [50 psig (345 kPa)] [100 psig (690 kPa)] [150 psig (1035 kPa)] unless otherwise indicated.

B. Seismic Performance: Water piping shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For water piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.3, "Process Piping," for piping conveying fluid at a pressure of 15 psig (105 kPa) or greater.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE AND FITTINGS

A. Schedule 40, CPVC Pipe and Fittings: ASTM F 441/F 441M pipe; with plain ends for solvent-cemented joints and ASTM F 438, socket-type fittings.

B. Schedule 80, CPVC Pipe and Fittings: ASTM F 441/F 441M pipe; with plain ends for solvent-cemented joints and ASTM F 439, socket-type fittings.

C. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
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a. Asahi/America.  
b. George Fischer LLC.  
c. IPEX Inc.  
d. NIBCO INC.  
e. Orion Fittings; a division of Watts Water Technologies Inc.  
f. Town & Country Plastics, Inc.

2. Schedule 40, Pipe and Fittings: Pipe made to ASTM D 2447, Schedule 40 or SDR 11 dimensions; with socket- or butt-fusion fittings matching pipe dimensions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. George Fischer LLC.

2. Schedule 80, Pipe and Fittings: Pipe made to ASTM D 2447, Schedule 80 dimensions; with socket fittings matching pipe dimensions.

F. Schedule 40, PVC Pipe and Fittings: ASTM D 1785 pipe; with plain ends for solvent-cemented joints and ASTM D 2466, socket-type fittings.

G. Schedule 80, PVC Pipe and Fittings: ASTM D 1785 pipe; with plain ends for solvent-cemented joints and ASTM D 2467, socket-type fittings.

   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. PVDF Pipe and Fittings: Made from ASTM D 3222, PVDF resin.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Asahi/America.
      b. George Fischer LLC.
      c. NIBCO INC.
      d. Orion Fittings; a division of Watts Water Technologies Inc.
   2. Schedule 40, Pipe and Fittings: Pipe made to ASTM D 2447, Schedule 40 or SDR 11 dimensions; with socket- or butt-fusion fittings matching pipe dimensions.
2.2 GLASS PIPE AND FITTINGS

A. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
   
      1. **QVF**: a member of De Dietrich Process Systems, Inc.

B. Glass Pipe and Fittings: Beaded borosilicate glass made for process-piping applications.

C. Couplings: Stainless-steel band type with fluororubber liner, thermoplastic-elastomer seal, and bolt.

2.3 STAINLESS-STEEL TUBING

A. Stainless-Steel Tube: ASTM A 270, Grade TP304L or TP316L, seamless, sanitary tube of pharmaceutical quality, with wall thickness not less than ASTM A 312/A 312M, Schedule 5 unless otherwise indicated; with seamless, stainless-steel fittings matching tube thickness and grade, for welded joints.

B. Stainless-Steel Tube Fittings: Fabricated of same material and thickness as tubing for butt welding.

C. Finish on Inside Surface of Tubes and Fittings: **Ra 20 micro-inch (Ra 0.5 micro-m)** maximum roughness.

D. Finish on Outside Surface of Tubes and Fittings: **<Insert finish>**.

2.4 TRANSITION FITTINGS

A. Transition Fittings: Couplings, flanges, or other manufactured fittings; same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.5 CPVC VALVES

A. CPVC Ball Valves:
   
      1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:

         a. **American Valve, Inc.**
         b. **Asahi/America.**
         c. **Colonial Engineering, Inc.**
         d. **George Fischer LLC.**
         e. **Hayward Flow Control Systems.**
         f. **IPEX Inc.**
         g. **NIBCO INC.**
         h. **Plast-O-Matic Valves, Inc.**
         i. **Spears Manufacturing Company.**
j. Thermoplastic Valves, Inc.

2. Description:
   b. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C)**.
   d. Body Design: Union type.
   e. End Connections: Detachable, socket.
   g. Port: Full.
   h. Seats: PTFE.
   i. Stem: ASTM D 1784, CPVC compound.
   j. Stem Seals: [EPDM] [FKM]-rubber O-rings.
   k. Handle: Tee shaped.

B. CPVC Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Colonial Engineering, Inc.
   b. George Fischer LLC.
   d. NIBCO INC.
   e. Spears Manufacturing Company.
   f. Thermoplastic Valves, Inc.

2. Description:
   b. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C)**.
   d. Body Design: [Lug] [or] [wafer] type.
   e. Seat: [EPDM] [FKM] rubber.
   f. Disc: [ASTM D 1784, CPVC compound] [ASTM D 4101, PP resin].
   g. Stem: Stainless steel.
   h. Stem Seals: [EPDM] [FKM]-rubber O-rings.
   i. Handle: Lever type with locking device.

C. CPVC Ball-Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. IPEX Inc.
g. **NIBCO INC.**

h. **Thermoplastic Valves, Inc.**

2. **Description:**

   b. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C).**
   d. Body Design: Union type.
   e. End Connections: Detachable, socket.
   g. Seat and Seals: [EPDM] [or] [FKM]-rubber O-rings.

**D. CPVC Swing-Check Valves:**

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

   a. **American Valve, Inc.**
   b. **Spears Manufacturing Company.**
   c. **Thermoplastic Valves, Inc.**

2. **Description:**

   b. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C).**
   e. End Connections: Flanged.
   g. Disc and Arm: ASTM D 1784, CPVC compounds.
   h. Gasket and Seals: [EPDM] [or] [FKM] rubber.

**E. CPVC Diaphragm Valves:**

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

   a. **Asahi/America.**
   b. **Colonial Engineering, Inc.**
   c. **George Fischer LLC.**
   d. **Hayward Flow Control Systems.**
   e. **NIBCO INC.**
   f. **Spears Manufacturing Company.**
   g. **Thermoplastic Valves, Inc.**

2. **Description:**

   b. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C).**
e. End Connections for NPS 2 (DN 50) and Smaller: Detachable, socket.
f. End Connections for NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Flanged.
g. Diaphragm: [EPDM] [FKM] rubber.
h. Seals: [EPDM] [FKM]-rubber O-rings.
i. Handle: Wheel type.

2.6 PP VALVES

A. PP Ball Valves:

1. following:

   a. Asahi/America.
   b. George Fischer LLC.
   c. IPEX Inc.
   d. NIBCO INC.
   e. Orion Fittings; a division of Watts Water Technologies Inc.
   f. Plast-O-Matic Valves, Inc.
   g. Thermoplastic Valves, Inc.

2. Description:

   b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
   d. Body Design: Union type.
   e. End Connections: Detachable, butt or socket.
   g. Port: Full.
   h. Seats: PTFE.
   k. Handle: Tee shaped.

B. PP Butterfly Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. IPEX Inc.
   g. Spears Manufacturing Company.
   h. Thermoplastic Valves, Inc.

2. Description:
a. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C)**.
c. Body Design: [Lug] [or] [wafer] type.
d. Seat: FKM rubber.
f. Stem: Stainless steel.
g. Stem Seals: FKM-rubber O-rings.
h. Handle: Lever type with locking device.

C. PP Ball-Check Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. George Fischer LLC.
   d. Hayward Flow Control Systems.
   e. NIBCO INC.
   f. Thermoplastic Valves, Inc.

2. Description:

   a. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C)**.
   d. End Connections: Detachable, socket.
   e. Ball: ASTM D 4101, PP resin.

D. PP Swing-Check Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   d. Spears Manufacturing Company.
   e. Thermoplastic Valves, Inc.

2. Description:

   a. Pressure Rating: **150 psig (1035 kPa)** at **73 deg F (23 deg C)**.
   d. End Connections: Flanged.
   f. Disc and Arm: ASTM D 4101, PP resin.
   g. Gasket and Seals: FKM rubber.
E. PP Diaphragm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
   a. American Valve, Inc.
   b. Asahi/America.
   c. George Fischer LLC.
   d. NIBCO INC.
   e. Spears Manufacturing Company.
   f. Thermoplastic Valves, Inc.

2. Description:
   
   a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
   d. End Connections for NPS 2 (DN 50) and Smaller: Detachable, socket.
   e. End Connections for NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Flanged.
   f. Diaphragm: FKM rubber.
   g. Seals: FKM-rubber O-rings.
   h. Handle: Wheel type.

2.7 PVC VALVES

A. PVC Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. IPEX Inc.
   g. Legend Valve.
   h. NIBCO INC.
   i. Plast-O-Matic Valves, Inc.
   j. Spears Manufacturing Company.
   k. Thermoplastic Valves, Inc.

2. Description:
   
   b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
   d. Body Design: Union type.
   e. End Connections: Detachable, socket.
g. Port: Full.
h. Seats: PTFE.
i. Stem: ASTM D 1784, PVC compound.
j. Seals: [EPDM] [FKM]-rubber O-rings.
k. Handle: Tee shaped.

B. PVC Butterfly Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. Legend Valve.
   g. NIBCO INC.
   h. Spears Manufacturing Company.
   i. Thermoplastic Valves, Inc.

2. Description:

   b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
   d. Body Design: [Lug] [or] [wafer] type.
   e. Seat: [EPDM] [FKM] rubber.
   f. Disc: [ASTM D 1784, PVC compound] [ASTM D 4101, PP resin].
   g. Stem: Stainless steel.
   h. Stem Seals: [EPDM] [or] [FKM]-rubber O-rings.
   i. Handle: Lever type with locking device.

C. PVC Ball-Check Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. IPEX Inc.
   g. Legend Valve.
   h. NIBCO INC.
   i. Thermoplastic Valves, Inc.

2. Description:

b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).


d. Body Design: Union type.

e. End Connections: Detachable, socket.


g. Seat and Seals: EPDM or FKM-rubber O-rings.

D. PVC Swing-Check Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   d. IPEX Inc.
   e. Legend Valve.
   f. Spears Manufacturing Company.
   g. Thermoplastic Valves, Inc.

2. Description:

   b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
   e. End Connections: Flanged.
   g. Disc and Arm: ASTM D 1784, PVC compounds.
   h. Gasket and Seals: EPDM or FKM-rubber.

E. PVC Diaphragm Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. George Fischer LLC.
   e. Hayward Flow Control Systems.
   f. NIBCO INC.
   g. Spears Manufacturing Company.
   h. Thermoplastic Valves, Inc.

2. Description:

   b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
e. End Connections for NPS 2 (DN 50) and Smaller: Detachable, socket.
f. End Connections for NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Flanged.
g. Diaphragm: [EPDM] [FKM] rubber.
h. Seals: [EPDM] [FKM]-rubber O-rings.
i. Handle: Wheel type.

2.8 PVDF VALVES

A. PVDF Ball Valves:

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

a. Asahi/America.
b. George Fischer LLC.
c. NIBCO INC.
d. Orion Fittings: a division of Watts Water Technologies Inc.
e. Plast-O-Matic Valves, Inc.
f. Thermoplastic Valves, Inc.

2. Description:

b. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
d. Body Design: Union type.
e. End Connections: Detachable, butt or socket.
f. Ball: ASTM D 3222, PVDF resin.
g. Port: Full.
h. Seats: PTFE.
i. Stem: ASTM D 3222, PVDF resin.
k. Handle: Tee shaped.

B. PVDF Butterfly Valves:

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

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. George Fischer LLC.
e. Thermoplastic Valves, Inc.

2. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
c. Body Design: [Lug] [or] [wafer] type.
C. PVDF Ball-Check Valves:

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

   a. Asahi/America.
   b. George Fischer LLC.
   c. Legend Valve.
   d. NIBCO INC.
   e. Thermoplastic Valves, Inc.

2. Description:

   a. Pressure Rating: **150 psig (1035 kPa) at 73 deg F (23 deg C)**.
   d. End Connections: Detachable, socket.
   e. Ball: ASTM D 3222, PVDF resin.

D. PVDF Swing-Check Valves:

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

   a. American Valve, Inc.
   b. Asahi/America.
   c. Thermoplastic Valves, Inc.

2. Description:

   a. Pressure Rating: **150 psig (1035 kPa) at 73 deg F (23 deg C)**.
   d. End Connections: Flanged.
   e. Shaft: ASTM D 3222, PVDF resin.
   f. Disc and Arm: ASTM D 3222, PVDF resins.
   g. Gasket and Seals: FKM rubber.

E. PVDF Diaphragm Valves:

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

   a. American Valve, Inc.
2. Description:

a. Pressure Rating: **150 psig (1035 kPa) at 73 deg F (23 deg C)**.
d. End Connections for NPS 2 (DN 50) and Smaller: Detachable, socket.
e. End Connections for NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Flanged.
f. Diaphragm: FKM rubber.
g. Seals: FKM-rubber O-rings.
h. Handle: Wheel type.

2.9 GLASS BALL VALVES

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

1. Andrews Glass Co.
2. QVF; a member of De Dietrich Process Systems, Inc.

B. Description:

1. Minimum Pressure Rating: **70 psig (483 kPa)**.
5. Ball: Borosilicate glass.
6. Port: Regular.
7. Seats: TFE.
8. Stem: Fused alumina.
9. Stem Seal: TFE.

2.10 STAINLESS-STEEL BALL VALVES

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

1. Conbraco Industries, Inc.
2. Marvin Valve; a division of Richards Industries.

B. Description:
2. Minimum CWP Rating: **1000 psig** *(6895 kPa).*
5. End Connections: Socket welding.
6. Seats: PTFE or TFE.
7. Stem: Stainless steel.

**PART 3 - EXECUTION**

3.1 **PIPING INSTALLATION**

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of water piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. 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."

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for removal of ceiling panel, and coordinate with other services occupying that space.

F. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure ratings unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. 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."
L. 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."

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. CPVC Piping Solvent-Cemented Joints: Comply with ASTM F 402 for handling solvent cements, primers, and cleaners; make joints according to ASTM D 2846/D 2846M Appendix.

C. PP Piping Electro-Fusion Joints: Make according to ASTM F 1290.

D. PP Piping Heat-Fusion Joints: Make according to ASTM D 2657.

E. PVC Piping Solvent-Cemented Joints: Comply with ASTM F 402 for handling solvent cements, primers, and cleaners; make joints according to ASTM D 2672.

F. PVDF Piping Heat-Fusion Joints: Make according to ASTM D 2657.

G. Glass Piping Joints: Make with pipe manufacturer's couplings.

H. Stainless-Steel Sanitary Tubing Joints: Make fully penetrated-wall, butt-welding joints without use of filler metal. Comply with AWS D1.6/D1.6M for welding procedures and processes. Polish exterior of welds to match tubing.

I. Join dissimilar pipe materials with transition fittings compatible with pipe materials being joined.

3.3 VALVE INSTALLATION

A. Install sectional valves close to mains on each branch and riser serving equipment.

B. Install shutoff valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves of same size as the pipe or tube in which they are installed unless otherwise indicated.

E. Install plastic valves of the same material as the plastic pipe in which they are installed.

F. Install glass valves in glass piping.
G. Install stainless-steel valves in stainless-steel tubing.

H. Install valves in horizontal piping with stem at or above center of pipe.

I. Install valves in position to allow full movement of stem and lever handle.

J. Install ball-check valves in horizontal or vertical position so ball will unseat during normal flow.

K. Install swing-check valves in horizontal position with the hinge pin level.

3.4 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."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install [stainless-steel] [fiberglass] 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. Clamps for Vertical Piping: MSS Type 8 or Type 42.
6. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs, 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) 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, to minimum 3/8 inch (10 mm).

F. Install padded hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
G. Install padded supports for vertical CPVC piping NPS 2-1/2 (DN 65) and larger every 120 inches (3000 mm) and midstory for NPS 2 (DN 50) and smaller.

H. Install padded hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 (DN 25) and Smaller: 32 inches (813 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

I. Install padded supports for vertical PP piping NPS 2-1/2 (DN 65) and larger every 120 inches (3000 mm) and midstory for NPS 2 (DN 50) and smaller.

J. Install padded hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

K. Install padded supports for vertical PVC piping NPS 2-1/2 (DN 65) and larger every 120 inches (3000 mm) and midstory for NPS 2 (DN 50) and smaller.

L. Install padded hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 (DN 25) and Smaller: 30 inches (750 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/4 (DN 32): 33 inches (840 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 36 inches (900 mm) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

M. Install padded supports for vertical PVDF piping NPS 2-1/2 (DN 65) and larger every 120 inches (3000 mm) and midstory for NPS 2 (DN 50) and smaller.

N. Install padded hangers for glass piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   3. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.

O. Install padded supports for vertical glass piping every 96 inches (2400 mm).

P. Install hangers for stainless-steel tubing with the following maximum horizontal spacing and minimum rod diameters:
1. **NPS 1 and NPS 1-1/4 (DN 25 and DN 32):** 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50):** 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. **NPS 2-1/2 (DN 65):** 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. **NPS 3 (DN 80):** 10 feet (3 m) with 1/2-inch (13-mm) rod.

**Q.** Install supports for vertical stainless-steel tubing every 10 feet (3 m).

**R.** Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

**A.** Drawings indicate general arrangement of piping, fittings, and specialties.

**B.** Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

**C.** Connect [reagent-water] [deionized-water] [distilled-water] [and] [reverse-osmosis-water] piping to equipment and service outlets with unions or flanges.

### 3.6 IDENTIFICATION

**A.** Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.7 FIELD QUALITY CONTROL

**A.** Test new piping, and parts of existing piping that have been altered, extended, or repaired, for leaks and defects.

1. Schedule tests and their inspections by [authorities having jurisdiction] [Cleveland Clinic], with at least 24 hours’ advance notice.
2. Do not cover piping or put into service before inspection and approval.
3. Test completed piping according to [authorities having jurisdiction] [Cleveland Clinic]. If [authorities having jurisdiction do] [Cleveland Clinic does] not have published procedures, perform tests as follows:
   1. **Hydrostatic Tests:** Test piping at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than [50 psig (345 kPa)] [100 psig (690 kPa)] [150 psig (1035 kPa)].
      
   1) Exception: Do not subject glass piping to pressure above manufacturer's pressure rating for size.

4. Replace leaking joints with new materials and retest until no leaks exist.
5. Submit separate reports for each test.
3.8 CLEANING

A. Use procedures prescribed by [authorities having jurisdiction] [Cleveland Clinic] or, if not prescribed, use procedures described below:

1. Before using, purge new piping and parts of existing piping that have been altered, extended, or repaired.
2. Clean piping by flushing with [reagent] [deionized] [distilled] [and] [reverse-osmosis] water.

3.9 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping, and of same or compatible material, may be used in applications below.

B. Reagent-Water Piping: Use[ any of] the following piping materials for each pipe size range:

1. Pipe Sizes NPS 3 (DN 80) and Smaller: Schedule 40, CPVC pipe and fittings and solvent-cemented joints.
2. Pipe Sizes NPS 3 (DN 80) and Smaller: Schedule 80, CPVC pipe and fittings and solvent-cemented joints.
3. Pipe Sizes NPS 3 (DN 80) and Smaller: PP pipe and fittings and heat-fusion joints.
4. Pipe Sizes NPS 3 (DN 80) and Smaller: PP pipe and fittings and electro-fusion joints.
5. Pipe Sizes NPS 3 (DN 80) and Smaller: Schedule 40, PVC pipe and fittings and solvent-cemented joints.
6. Pipe Sizes NPS 3 (DN 80) and Smaller: Schedule 80, PVC pipe and fittings and solvent-cemented joints.
7. Pipe Sizes NPS 3 (DN 80) and Smaller: PVDF pipe and fittings and heat-fusion joints.
8. Pipe Sizes NPS 3 (DN 80) and Smaller: Glass pipe and fittings and coupled joints.
9. Pipe Sizes NPS 3 (DN 80) and Smaller: Stainless-steel sanitary tubing and welded joints.

C. Deionized-Water Piping: Use[ any of] the following piping materials for each pipe size range:

1. NPS 3 (DN 80) and Smaller: PP pipe and fittings and heat-fusion joints.
2. NPS 3 (DN 80) and Smaller: PP pipe and fittings and electro-fusion joints.
3. NPS 3 (DN 80) and Smaller: PVDF pipe and fittings and heat-fusion joints.
4. NPS 3 (DN 80) and Smaller: Glass pipe and fittings and coupled joints.
5. NPS 3 (DN 80) and Smaller: Stainless-steel sanitary tubing and welded joints.

D. Distilled-Water Piping: Use[ any of] the following piping materials for each pipe size range:

1. NPS 3 (DN 80) and Smaller: PP pipe and fittings and heat-fusion joints.
2. NPS 3 (DN 80) and Smaller: PP pipe and fittings and electro-fusion joints.
3. NPS 3 (DN 80) and Smaller: PVDF pipe and fittings and heat-fusion joints.
4. NPS 3 (DN 80) and Smaller: Glass pipe and fittings and coupled joints.
5. NPS 3 (DN 80) and Smaller: Stainless-steel sanitary tubing and welded joints.

E. Reverse-Osmosis-Water Piping: Use[ any of] the following piping materials for each pipe size range:
1. **NPS 3 (DN 80)** and Smaller: PP pipe and fittings and heat-fusion joints.
2. **NPS 3 (DN 80)** and Smaller: PP pipe and fittings and electro-fusion joints.
3. **NPS 3 (DN 80)** and Smaller: PVDF pipe and fittings and heat-fusion joints.
4. **NPS 3 (DN 80)** and Smaller: Glass pipe and fittings and coupled joints.
5. **NPS 3 (DN 80)** and Smaller: Stainless-steel sanitary tubing and welded joints.

### 3.10 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. **Shutoff Duty**: Install ball valves in piping **NPS 2 (DN 50)** and smaller. Install butterfly or diaphragm valves for **NPS 3 (DN 80)** piping.
2. **Throttling Duty**: Install ball valves in piping **NPS 2 (DN 50)** and smaller. Install diaphragm valves for **NPS 3 (DN 80)** piping.

**END OF SECTION 226700**