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WMU Design Guidelines

WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeve-seal systems.
5. Sleeves.
7. Escutcheons.
8. Floor plates.
11. Equipment installation requirements common to equipment sections.
12. Painting and finishing.
13. Concrete bases.

B. Related Sections:

1. Division 01 Section "Alternates" for requirements of alternates that relate to this Division.

1.2 DEFINITIONS

1.3 ACTION SUBMITTALS

A. Product Data: For dielectric fittings.

1.4 QUALITY ASSURANCE

A. Provide plumbing systems, equipment, and materials in accordance with applicable codes and regulations, and with authorities having jurisdiction.
B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and sleeves in structural components.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.7 PROJECT COMMISSIONING

A. Project is attempting to obtain LEED Certification and has an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All [grooved joint] couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
2. ABS Piping: ASTM D 2235.
3. CPVC Piping: ASTM F 493.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 DIELECTRIC FITTINGS

A. Dielectric Connections: Ground joint, copper unions, ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends; and suitable system fluid, pressure and temperature.

B. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.

C. Description: Combination fitting of copper alloy and ferrous materials with threaded end connections that match piping system materials.

1. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F with threaded end connections.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.5 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.
6. Thunderline

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. 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.
4. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.
6. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.6 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.


E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to [wooden forms].

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.7 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.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.

F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.9 FLOOR PLATES

A. Description: Manufactured floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

B. One-Piece Floor Plates: Cast-iron flange.

C. One-Piece Floor Plates: Cast-iron flange [with holes for fasteners].

D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 GROUT


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

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.11 PLUMBING ROOF PENETRATIONS

A. Pipe Curbs for Single or Multiple Pipe Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, wood nailer,
and acrylic clad ABS plastic cover(s), PVC boot(s), and stainless steel clamps. Size as required to suit roof opening and piping. Overall minimum height shall be 12 inches above roof insulation. Paté or equivalent.

1. Provide curbs with level tops and bottoms to match roof slope.

B. Pipe Curbs for Single Pipe Penetrations: All roof pipe penetrations up to 10" O.D. shall be flashed and sealed using a Paté or equivalent pipe seal, consisting of a spun aluminum base having a minimum five inch roof surface flange, a stepped polyvinyl chloride boot to be secured to the base and the pipe with adjustable stainless steel clamps as furnished.

1. Provide curbs with bottoms to match roof slope.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. During domestic water demolition, eliminate all "dead-leg" sections.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. 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.

1. Drawings are diagrammatic with no attempt made to show every ell, tee, transition, fitting, or appurtenance. Provide installations that are complete in every detail, compliant with all applicable codes, and as required to provide a fully functional and operational system even though every item is not specifically indicated.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

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. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation.

L. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:

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 or split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   d. Insulated Piping: One-piece, stamped-steel type [or split-plate, stamped-steel type with concealed hinge] [or split-plate, stamped-steel type with exposed-rivet hinge].
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type [or split-plate, stamped-steel type with concealed hinge] [or split-plate, stamped-steel type with exposed-rivet hinge].

g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.

h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type [or split-plate, stamped-steel type with concealed hinge] [or split-plate, stamped-steel type with exposed-rivet hinge].

i. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.

j. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type [or split-plate, stamped-steel type with concealed hinge] [or split-plate, stamped-steel type with exposed-rivet hinge].

k. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.

l. Bare Piping in Equipment Rooms: One-piece, stamped-steel type [or split-plate, stamped-steel type with concealed hinge] [or split-plate, stamped-steel type with exposed-rivet hinge].

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 concealed or 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 Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.

g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.

h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.

i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with [concealed] [or] [exposed-rivet] hinge.

3.4 FLOOR PLATE INSTALLATION

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

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.
3.5 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   1. Sleeves are not required for core-drilled holes.

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

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout, seal 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 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 07 9200 "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 07 8413 "Penetration Firestopping."

3.6 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 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 07 6200 "Sheet Metal Flashing and Trim."
   3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   5. Using 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 07 8413 "Penetration Firestopping."

3.7 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.

3.8 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: Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] [Sleeve-seal fittings] <Insert material>.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.
   d. Piping [NPS 6] <Insert pipe size> and Larger: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] <Insert material>.

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [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] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
   d. Piping [NPS 6] <Insert pipe size> 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] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [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] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
   d. Piping [NPS 6] <Insert pipe size> 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] <Insert material>.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Stack-sleeve fittings.
   b. Piping Smaller Than [NPS 6] <Insert pipe size>: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] [Stack-sleeve fittings] [Sleeve-seal fittings] [Molded-PE or -PP sleeves] [Molded-PVC sleeves] <Insert material>.
   c. Piping NPS 6 and Larger: Stack-sleeve fittings.
   d. Piping [NPS 6] <Insert pipe size> and Larger: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] [Stack-sleeve fittings] <Insert material>.

5. Interior Partitions:

3.9 PIPING JOINT CONSTRUCTION
   A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
   B. Ream ends of pipes and tubes and remove burrs.
   C. Ream ends of pipes and tubes and remove burrs[. Bevel plain ends of steel pipe].
   D. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads 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.

H. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

J. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

K. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

L. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

M. 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.

N. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.10 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Connect piping materials of dissimilar metals as follows:
   a. In piping NPS 2(DN 50) and smaller, install ground joint unions.
   b. In piping NPS 2-1/2(DN 65) and larger, install dielectric flanges.
4. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
5. Wet Piping Systems: Install dielectric unions, dielectric coupling, or dielectric nipple fittings to connect piping materials of dissimilar metals.

3.11 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate installations of plumbing equipment.
B. Sequence, coordinate, and integrate installations of plumbing equipment[, giving particular attention to large equipment requiring positioning prior to closing in the building].
C. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
E. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
F. Install equipment to allow right of way for piping installed at required slope.
G. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.
H. Verify final equipment locations for roughing-in.
I. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.12 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 painting sections.
B. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
3.13 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer’s written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches 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 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. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section “Metal Fabrications” for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.16 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Place grout, completely filling equipment bases.
5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

B. Mix and install grout for plumbing installations.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Cure placed grout.

3.17 PLUMBING ROOF PENETRATIONS

A. Install plumbing roof penetrations in accordance with roof curb manufacturer’s recommendations and in strict compliance with roofing manufacturer’s requirements.

1. Roofs with Warranty: Roof penetrations and curbs shall be installed in such a manner to maintain roofing warranty.

B. Pipe Curbs for Pipe Penetrations: Secure boot to curb base and secure boot to pipe with adjustable stainless steel clamps.

3.18 INSTALLATION OF ACCESS DOORS

A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

3.19 FIELD QUALITY CONTROL

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

END OF SECTION 22 0500
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**SECTION 22 0513 - 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 general-purpose motors for use on ac power systems and installed at equipment manufacturer's factory.

B. 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.

C. 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.

B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.
2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

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

2.2 MOTOR CHARACTERISTICS

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

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

2.3 POLYPHASE MOTORS

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

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

1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

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

H. Temperature Rise: Class B.

I. Temperature Rise: Match insulation rating.

J. Insulation: Class F.

K. Insulation: [Class F] <Insert class>.
L. Code Letter Designation:

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

M. Enclosure Material: Manufacturer’s standard material.

N. Enclosure Material: Cast iron for motor frame sizes [324T] <Insert number> and larger; rolled steel for motor frame sizes smaller than [324T] <Insert number>.

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 controller.

C. 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. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Shaft Grounding Ring: Factory installed shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.
4. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
5. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

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

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

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

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

2.6 ELECTRONIC COMMUTATION MOTOR (ECM)

A. Description: Motor to be an electronic commutation motor (ECM) specifically designed for direct drive applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the equipment load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

3.1 EXECUTION

3.2 SHAFT GROUNDING RING INSTALLATION

A. If not factory installed, field install at each three phase motors utilizing a variable frequency controller a shaft grounding ring. Attach according to manufacturer’s written instructions.

END OF SECTION 22 0513
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SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermometers.
   2. Gages.
   3. Test plugs.

B. Related Sections:
   1. Division 22 Section "Facility Water Distribution Piping" for domestic and fire-protection water service meters outside the building.
   2. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
   3. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

1.2 DEFINITIONS

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.

1.6 QUALITY ASSURANCE

A. NSF Compliance as required by authorities having jurisdiction:
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content”

PART 2 - PRODUCTS

2.1 DIGITAL THERMOMETERS

A. Manufacturer: Match Owner’s campus standard.

B. Description: Hi-impact ABS self contained solar powered, vari-angle digital thermometer, stem mounted with adjustable joint for liquid application.

2.2 LIQUID-IN-GLASS THERMOMETERS

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

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

1. Ashcroft.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
5. Ashcroft.
7. Miljoco Corp.
8. Trerice, H. O. Co.
9. Weiss Instruments, Inc.
10. Weksler Instruments.
11. Ernst Gage Co.
12. Eugene Ernst Products Co.
13. Palmer - Wahl Instruments Inc.

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

D. Case: Metal or plastic, 9 inches long.

E. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
F. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

G. Window: Glass or plastic.

H. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

I. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

J. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

2.4 PLASTIC-CASE, LIQUID-IN-GLASS THERMOMETERS

2.5 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

2.6 REMOTE-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

2.7 BIMETALLIC-ACTUATED DIAL THERMOMETERS

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

1. Ashcroft.
2. Ernst Gage Co.
3. Eugene Ernst Products Co.
5. Miljoco Corp.
6. Palmer - Wahl Instruments Inc.
7. Trerice
8. Weiss Instruments, Inc.
9. Weksler

B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

C. Case: Silicone dampened, stainless steel with 5-inch diameter.

D. Element: Bimetal coil.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
F. Pointer: Red or other dark-color metal.

G. Window: Glass or plastic.

H. Ring: Stainless steel.

I. Connector: Adjustable angle type.

J. Stem: Stainless Steel, for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.8 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

C. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.9 PRESSURE GAGES

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

1. Ashcroft.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
5. Ashcroft.
7. Miljoco Corp.
8. Trerice, H. O. Co.
9. Weiss Instruments, Inc.
10. Weksler Instruments.
11. Ernst Gage Co.
12. Eugene Ernst Products Co.
13. Palmer - Wahl Instruments Inc.
15. REO TEMP Instrument Corporation.
17. KOBOLD Instruments, Inc.
18. WIKA Instrument Corporation.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ashcroft.
2. Marsh Bellofram.
3. Trerice, H. O. Co.
4. Weksler.
5. Weiss Instruments.

C. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
   1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
   2. Case: [Dry] Liquid-filled type, [drawn steel or cast aluminum] [metal or plastic] [plastic], [4-1/2-inch] [6-inch] <Insert other> diameter.
   3. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
   4. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
   5. Movement: Mechanical, with link to pressure element and connection to pointer with front recalibration.
   7. Pointer: Red or other dark-color metal.
   8. Window: Glass or plastic.
   9. Window: [Glass] [Glass or plastic] [Plastic] <Insert other>.
   10. Ring: Metal.
   11. Ring: [Metal] [Brass] [Stainless steel] [Metal or plastic] [Plastic].
   12. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
   13. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
   14. Range for Fluids under Pressure: Two times operating pressure.

D. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.
   1. Case: Dry type, [drawn steel or cast aluminum] <Insert other> 4-1/2-inch [6-inch] <Insert other> diameter with [holes] <Insert other> for panel mounting.
   2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
   3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
   4. Movement: Mechanical, with link to pressure element and connection to pointer.
   6. Pointer: Red or other dark-color metal.
   7. Window: [Glass] [Glass or plastic] [Plastic] <Insert other>.
   8. Ring: [Metal] [Brass] [Stainless steel] [Metal or plastic] [Plastic].
   9. Accuracy: Grade A, plus or minus 1 percent of middle half [B, plus or minus 2 percent of middle half] [C, plus or minus 3 percent of middle half] [D, plus or minus 5 percent of whole] scale.
   10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
   11. Range for Fluids under Pressure: Two times operating pressure.

E. Pressure-Gage Fittings:
   1. Valves: NPS 1/4 brass ball type.
2. Valves: NPS 1/4 brass or stainless-steel needle type.
3. Tubing: NPS 1/4(DN 8) copper.
4. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.10 TEST PLUGS

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

1. Flow Design, Inc.
2. MG Piping Products Co.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
8. <Insert manufacturer's name.>

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
8. <Insert manufacturer's name.>

C. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

D. Minimum Pressure and Temperature Rating: [500 psig at 200 deg F] <Insert other>.

E. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.
2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

F. Test Kit: Furnish [one] <Insert other> test kit(s) containing one pressure gage and adaptor, [one] [two] thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with [2- to 3-inch-] <Insert other> diameter dial and probe. Dial range shall be [0 to 200 psig] <Insert other>.
2. Low-Range Thermometer: Small bimetallic insertion type with [1- to 2-inch-] <Insert other> diameter dial and tapered-end sensing element. Dial ranges shall be [25 to 125 deg F] <Insert other>.
3. High-Range Thermometer: Small bimetallic insertion type with [1- to 2-inch-] <Insert other> diameter dial and tapered-end sensing element. Dial ranges shall be [0 to 220 deg F] <Insert other>.
4. Carrying case shall have formed instrument padding.
PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers in the outlet of each domestic hot-water storage tank and elsewhere as indicated on drawings.

B. Install [liquid-in-glass] [direct-mounting, vapor-actuated dial] [remote-mounting, vapor-actuated dial] [bimetallic-actuated dial] thermometers in the outlet of each domestic, hot-water storage tank.

C. Install [dry] [liquid-filled]-case-type, [vapor] [bimetallic]-actuated dial thermometers at suction and discharge of each pump.

D. Provide the following temperature ranges for thermometers:
   1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
   2. Domestic Hot Water: [30 to 180 deg F, with 2-degree scale divisions] [30 to 240 deg F, with 2-degree scale divisions] <Insert other>.
   3. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
   4. Domestic Cold Water: [0 to 100 deg F, with 2-degree scale divisions] [30 to 130 deg F, with 2-degree scale divisions] <Insert other>.

3.2 GAGE APPLICATIONS

A. Install pressure gages for discharge of each pressure-reducing valve and elsewhere as indicated.

B. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

C. Install pressure gages at suction and discharge of each pump.

D. Install [dry] [liquid-filled]-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

D. Install thermowells with socket extending [a minimum of 2 inches into fluid] [one-third of diameter of pipe] [to center of pipe] and in vertical position in piping tees where thermometers are indicated.
E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

1. Provide elbows as required to install gauges at location and angle readable from standing position on floor.

F. Install remote-mounting pressure gages on panel.

G. Install ball valve and snubber fitting in piping for each pressure gage.

H. Install needle-valve and snubber fitting in piping for each pressure gage.

I. Install test plugs in tees in piping.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install connection fittings for attachment to portable indicators in accessible locations.

L. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

M. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 22 0519
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SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. Iron, lug type butterfly valves.
   4. Bronze swing check valves.
   5. Iron swing check valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

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

C. NSF Compliance as required by authorities having jurisdiction:
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect valve ends from damage.
   3. Protect [threads, [flange faces, [grooves, ]and ]]weld ends).
   4. Set angle, gate, and globe valves closed to prevent rattling.
   5. Set ball valves open to minimize exposure of functional surfaces.
   7. Set butterfly valves closed or slightly open.
   8. 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. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

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

D. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 6 and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 and smaller.
   4. 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.

E. Valves in Insulated Piping: Valves with more than 1/2-inch insulation shall have stem extensions or extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
F. Valves in Insulated Piping: Valves in domestic cold water lines with more than 1/2-inch insulation shall include the following:

1. Ball Valves: Stem extensions or 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. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. 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.

H. 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.

2.2 BRONZE BALL VALVES

A. Manufacturers:

1. Apollo.
2. Hammond.
3. Milwaukee.

B. Ball Valves, NPS 2 and Smaller: Lead Free, Two-Piece, ASTM B62, 400psi WOG pressure, bronze body with bronze trim, full port, 316 stainless steel ball and stem, replaceable “TFE” seats and seal, blowout proof stem, vinyl covered handle, and threaded ends.

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Red-White Valve Corporation.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. American Valve, Inc.
   i. Lance Valves; a division of Advanced Thermal Systems, Inc.
   j. Legend Valve.

2. Description:
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b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece, threaded.
e. Body Material: B584 Cast Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 IRON, LUG TYPE 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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Division.
   e. DeZurik Water Controls.
   f. Hammond Valve.
   g. Kitz Corporation.
   h. Legend Valve.
   i. Milwaukee Valve Company.
   j. NIBCO INC.
   k. Red-White Valve Corporation.
   l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   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: Aluminum bronze.

2.4 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. Anvil International, Inc.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Shurjoint Piping Products.
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2. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 175 psig.
   c. Body Material: Coated, ductile iron.
   e. Disc: Aluminum bronze.
   f. Seal: EPDM.

2.5 BRONZE SWING CHECK VALVES

A. Manufacturers:
   1. NIBCO, INC.
   2. Conbraco Industries, Inc.; Apollo Valves.
   3. Milwaukee.

B. Swing Check Valves: Lead-Free, ASTM B61, class 150 bronze body, disc and cap, y-pattern with threaded ends.

C. Class 125, Bronze Swing Check 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; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Hammond Valve.
      e. Milwaukee Valve Company.
      f. NIBCO INC.
      g. Red-White Valve Corporation.
      h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: PTFE or TFE.

2.6 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:

   d. Tyco / Grinnell.
   e. Victaulic Company.

   Tyco / Grinnell.
   e. Victaulic Company.
a. Hammond Valve.
b. Kitz Corporation.
c. Legend Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.

2. Description:

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

2.7 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 / Grinnell.
   d. Victaulic Company.

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

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 check valves for proper direction of flow.

3.3 ADJUSTING

A. Adjust or replace leaking 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. Valve Applications:

1. Domestic Water:
   a. Shutoff Service: Ball and butterfly valves.
   b. Throttling Service: Ball and butterfly valves.
   c. Check Valves:
      1) NPS 2(DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.
      2) NPS 2-1/2(DN 65) and Larger: Iron swing type check valves with metal seat.

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 with the following end connections:

   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing: Valve ends may be grooved.
8. For Grooved-End [Copper Tubing] [and] [Steel Piping]: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze with stainless steel trim.
   3. Bronze Swing Check Valves: Class 125, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:
   3. Iron Swing Check Valves: Class 125, metal seats.
   4. Iron, Grooved-End Swing Check Valves: 300 CWP.

3.6 FORCED MAIN WASTE PIPINING VALVE SCHEDULE

A. Pipe NPS 3 and Smaller:
   2. Ball Valves: Two piece, full port, bronze with bronze trim.
   3. Bronze Swing Check Valves: Class 125, nonmetallic disc.

END OF SECTION 22 0523
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe positioning systems.
   7. Fiberglass pipe hangers.
   8. Fiberglass strut systems.
   9. Pipe stands.
  10. Equipment supports.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers, and pipe and equipment supports.

C. See Division 21 fire-suppression sections for pipe hangers for fire-suppression piping.

D. See Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

E. See Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 DEFINITIONS

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

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
1.3 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. 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.

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

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings:[ Signed and sealed by a qualified professional engineer. ] Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized 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.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of [carbon steel] [stainless steel] <Insert material>.

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] <Insert material>.

2.3 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 hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of [polyurethane] [polyurethane or stainless steel] [stainless steel] <Insert other>.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.
2.5 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
   3. Channels: Continuous slotted steel channel with inturned lips.
   4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Metallic Coating: Electroplated zinc, hot-dipped galvanized, mill galvanized, in-line, hot galvanized, or mechanically-deposited zinc.
   8. Paint Coating: Vinyl, vinyl alkyd, epoxy, polyester, acrylic, amine, or alkyd.
   10. Combination Coating: Insert coating materials in order of application.

B. Non-MFMA Manufacturer Metal Framing Systems:
   1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Channels: Continuous slotted steel channel with inturned lips.
   4. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass or stainless steel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass or stainless steel.
   7. Coating: Zinc, paint, or PVC.

2.6 FIBERGLASS STRUT SYSTEMS

A. 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 or stainless steel.

2.7 THERMAL-HANGER SHIELD INSERTS

A. 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 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
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 1 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 ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. Insulation-Insert Material for Hot Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig] [ASTM C 552, Type II cellular glass with 100-psig] [or] [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig] minimum compressive strength.

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

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

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

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

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

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

2.9 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: Plastic unit with top configuration to support pipe for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic or 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 or 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.

2.10 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.

2.11 EQUIPMENT SUPPORTS

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

2.12 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified 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 and 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 [stainless-steel pipe hangers] [and] [fiberglass pipe hangers] [and] [fiberglass strut systems] and [stainless-steel] [or] [corrosion-resistant] attachments for hostile environment applications.

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

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

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

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

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

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

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

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

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

L. 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 20.

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

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

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

N. 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.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

O. 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.

P. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb 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 absorb 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 absorb 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:
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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.

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

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

S. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
   1. Use powder-actuated fasteners only in concrete construction that is suitable for their installation.

3.2 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 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 above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

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 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-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "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 inserts, bolts, rods, nuts, washers, and other accessories.


L. Install hangers and supports to allow controlled thermal 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 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.

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

O. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping.

P. 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.]

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

R. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

S. Insulated Piping: Comply with the following:
   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 according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   
a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:
   
a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. [Pipes NPS 8(DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts.]

6. Insert Material: Length at least as long as protective shield.

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

3.3 EQUIPMENT SUPPORTS

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

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

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

3.4 METAL FABRICATIONS

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

B. Cut, drill, and fit miscellaneous metal fabrications for [trapeze pipe hangers] [and] [equipment supports].

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

D. Field Welding: Comply with AWS D1.1 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 contours of welded surfaces match adjacent contours.
3.5 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches maximum.

3.6 PAINTING

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

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

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

END OF SECTION 22 0529
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SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Ceiling markers.
7. Warning tags.

1.2 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.

1.3 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.
1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 “Pipe Labeling Guide” for color scheme, length of field and letter height.


C. Comply with NFPA 99 and CGA 9 for medical gas pipe markers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials by one of the following:

1. Allen Systems, Inc.
2. Brady.
5. Brimar.

2.2 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: [Brass, 0.032-inch] [Stainless steel, 0.025-inch] [Aluminum, 0.032-inch] [or] [anodized aluminum, 0.032-inch] minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel [rivets] [rivets or self-tapping screws] [self-tapping screws].
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
5. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
7. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
8. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   a. Size of label shall be proportional to equipment size.
9. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2 inch.
10. Minimum Letter Size: 1 inch for name of units.
11. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
13. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

E. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, [1/16 inch] [1/8 inch] <Insert dimension> thick, and having predrilled holes for attachment hardware.

B. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

C. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel [rivets] [rivets or self-tapping screws] [self-tapping screws].

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic label including flow arrow formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to [partially cover] [cover full] circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include wrap around flow arrow tape with contact-type, permanent-adhesive backing.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Self-Adhesive Pipe Labels (Medical Gas): Printed wrap around type plastic label including flow arrow with contact-type, permanent-adhesive backing.

G. Pipe Label Contents: Include identification of piping service matching designations or abbreviations as used on Drawings.

H. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, black enamel unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.
4. Identification Paint: Exterior, [alkyd enamel] [acrylic enamel] <Insert paint type> in colors according to ASME A13.1 unless otherwise indicated.
2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Tag Material: [Brass, 0.032-inch] [Stainless steel, 0.025-inch] [Aluminum, 0.032-inch] [or]
   [anodized aluminum, 0.032-inch] minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Fasteners: Brass wire-link or beaded chain; or S-hook.
4. Fasteners: Brass [wire-link or beaded chain; or S-hook] [wire-link chain] [beaded chain]
   [S-hook].

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Provide glass front frame for each valve schedule for mounting in building mechanical room.
2. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: [3 by 5-1/4 inches minimum] [Approximately 4 by 7 inches] <Insert size>.
2. Fasteners: [Brass grommet and wire] [Reinforced grommet and wire or string].
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

2.8 CEILING MARKERS

A. Material and Thickness: Multicolor, vinyl markers.

B. Colors: Green.

C. Colors: Blue, red, yellow, and green.

D. Marker Size: 3/4 inch diameter.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Applications: Install pipe labels as follows:

1. Use pretensioned pipe labels or self-adhesive pipe labels.
2. For 10 inches (250 mm) and smaller outside diameter including insulation, use pretensioned pipe labels.
3. For larger than 10 inches (250 mm) outside diameter including insulation, use self-adhesive pipe labels.
4. For Medical Gas piping applications, use wrap around self-adhesive pipe labels.

B. Piping Color-Coding: Painting of piping is specified in Division 09 Section "[Interior Painting] [High-Performance Coatings]."

C. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

D. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels [with painted, color-coded bands or rectangles] [complying with ASME A13.1.] on each piping system.

1. Identification Paint: Use for contrasting background.

E. Locate pipe labels where piping is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run.

F. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run.
7. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

G. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:
   a. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
   b. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

2. Medium-Pressure, Compressed-Air Piping:
   a. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
   b. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

3. Domestic Water Piping:
   a. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
   b. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

4. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.
   b. Letter Color: [Black] [Blue] [Red] [White] [Yellow] <Insert color>.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Install glass front frame valve schedule in building mechanical room. Locate at Owners representative approved location.

C. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
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   a. Cold Water: [1-1/2 inches] [2 inches], [round] [square] <Insert shape>.
   b. Hot Water: [1-1/2 inches] [2 inches], [round] [square] <Insert shape>.
   c. Low-Pressure Compressed Air: [1-1/2 inches] [2 inches], [round] [square] <Insert shape>.
   d. High-Pressure Compressed Air: [1-1/2 inches] [2 inches], [round] [square] <Insert shape>.

   2. Valve-Tag Color:
      a. Cold Water: [Natural] [Green] <Insert color>.
      b. Hot Water: [Natural] [Green] <Insert color>.
      c. Low-Pressure Compressed Air: [Natural] [Green] <Insert color>.
      d. High-Pressure Compressed Air: [Natural] [Green] <Insert color>.

   3. Letter Color:
      a. Cold Water: [Black] [White] <Insert color>.
      b. Hot Water: [Black] [White] <Insert color>.
      c. Low-Pressure Compressed Air: [Black] [White] <Insert color>.
      d. High-Pressure Compressed Air: [Black] [White] <Insert color>.

3.5 CEILING MARKER INSTALLATION

   A. Install ceiling markers on t-bar ceiling grids and ceiling access panels to indicate locations of shut-off and balancing valves in main hot and cold piping lines and at branches.

   B. Color:

      1. Water: Green.
         a. No color differentiation between services required.

3.6 WARNING-TAG INSTALLATION

   A. Write required message on, and attach warning tags to, equipment and other items where required.
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SECTION 22 0700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1

1.2 SUMMARY

A. Section includes insulation materials for plumbing systems:

B. Related Sections:

1. Division 23 Section "HVAC Insulation."

1.3 ACTION SUBMITTALS

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

1. Insulation Materials:
   a. Mineral fiber.
   b. Flexible elastomeric.
   c. Cellular glass.
   d. Polyolefin.

2. Field-applied jackets.

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:

D. Samples:

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data.
B. Material Test Reports.
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.
B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
C. Mockups.

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 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
B. Coordinate clearance requirements with piping Installer for piping insulation application.
   1. 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. Insulation application may begin on segments that have satisfactory test results.
   1. Where required, schedule insulation application after installing and testing heat tracing
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 Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

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

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials 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-Lock, Insul-Tube, and K-FLEX LS.

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

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.

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

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

3. Type I, 850 Deg F 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.

J. 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. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F 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.

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

2.2 INSULATING CEMENTS


B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.


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.
1. 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. 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. Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. 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. 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: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

G. ASJ Adhesive[ and FSK Jacket Adhesive]: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. 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).

H. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. 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. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
2. Service Temperature Range: 0 to 180 deg F.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

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

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.

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. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
2. Service Temperature Range: 0 to plus 180 deg F.
4. 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).

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
5. 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. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
5. 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 PVC Jacket Flashing Sealants:

D. ASJ Flashing Sealants[ and Vinyl, PVDC,] and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
5. 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. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

C. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

D. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

E. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
2.10 FIELD-APPLIED JACKETS

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

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

1. Adhesive: As recommended by jacket material manufacturer.
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, and mechanical joints.
   b. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.

C. Metal Jacket:

   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-thick, heat-bonded polyethylene and kraft paper] [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil-thick polysurlyn].
   d. Moisture Barrier for Outdoor Applications: [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil-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.

2. 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-thick, heat-bonded polyethylene and kraft paper] [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil-thick polysurlyn].
   d. Moisture Barrier for Outdoor Applications: [3-mil-thick, heat-bonded polyethylene and kraft paper] [2.5-mil-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. Self-Adhesive Outdoor Jacket: Minimum 40-mil thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.

1. Coordinate color of optional colors with Architect and Owner.
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Polyguard; Alumaguard.
   b. MFM Building Products; Flex Clad 400

E. Underground Direct-Buried Jacket: 125-mil thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

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

1. Width: 3 inches.
2. Thickness: 11.5 mils.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive.

D. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

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

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316]; 0.015 inch thick, [1/2 inch] [3/4 inch] wide with [wing seal] [or] [closed seal].
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, [1/2 inch] [3/4 inch] 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-] [0.135-inch-] diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch-] [0.135-inch-] diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
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. Comply with the following requirements:
   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: [Copper- or zinc-coated, low carbon steel] [Aluminum] [Stainless steel], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. 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. Comply with the following requirements:
   a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
c. 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. Comply with the following requirements:
   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: [Copper- or zinc-coated, low carbon steel] [Aluminum] [Stainless steel], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.

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

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

D. Wire: 0.062-inch soft-annealed, stainless steel.

E. Wire: [0.080-inch nickel-copper alloy] [0.062-inch soft-annealed, stainless steel] [0.062-inch soft-annealed, galvanized steel].

2.13 CORNER ANGLES

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

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

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

2.14 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, <Insert drawing designation>:
   1. 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. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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

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

C. Coordinate insulation installation with the trade installing [heat tracing]. Comply with requirements for [heat tracing] that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids including fittings, valves, and specialties.
C. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

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

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

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

G. 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.

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

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

J. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

K. Keep insulation materials dry during application and finishing.

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

M. Install insulation with least number of joints practical.

N. 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.

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

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

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.


   a. For below-ambient services, apply vapor-barrier mastic over staples.

5. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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

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

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

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

   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Tank Manholes.
   5. Tank Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations:

B. 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 at roof structure and seal with joint sealant.
   3. 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.
   4. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   5. Seal jacket to roof flashing with flashing sealant.
C. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

D. 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.
   3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   5. Seal jacket to wall flashing with flashing sealant.

E. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

F. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 07 8413 “Penetration Firestopping” for firestopping and fire-resistant joint sealers.

G. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 “Penetration Firestopping.”

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

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 [100] [50] <insert percentage> 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 from insulation end joints, and 16 inches 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 from each end. Install wire or cable between two circumferential girdles 12 inches 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 o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.

8. Install 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 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 centers, starting at corners. Install 3/8-inch-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] [0.050 inch] [0.060 inch] 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.

3.6 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:

C. 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. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
3. 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.
4. 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.
5. 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.
6. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
7. 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.
8. 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.
9. 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.
10. For mineral fiber insulation, 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.
11. For mineral fiber insulation, 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.
12. 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.
13. Stencil or label the outside insulation jacket of each union with the word “union.” Match size and color of pipe labels.

D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels,
and equipment. 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.

E. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

3.8 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Roof Drain Sumps:

1. Install pipe insulation to bottom of roof drain sumps.
2. Secure insulation to roof drain sumps and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Roof Drain Bodies:

1. Install pipe insulation to bottom of roof drain bodies exposed within building.
2. Secure insulation to roof drain bodies and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. [Insulation Installation on Pipe Flanges]:

E. 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 manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

F. 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.

G. 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. Install insulation to flanges as specified for flange insulation application.
   5. 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.

3.9 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

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 mineral-fiber blanket insulation.
4. Install jacket material with manufacturer’s recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

D. 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.

E. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.
   5. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

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 overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

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

C. Where PVC fitting jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Paintable Jacket Material: Paint jacket with paint system identified in Division 09 painting Sections.

B. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
   1. Flat Acrylic Finish: [Two] <Insert number> finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

C. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

D. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

E. Do not field paint [aluminum or stainless-steel jackets].

3.13 FIELD QUALITY CONTROL

A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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] <Insert number> 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.
   2. 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] <Insert number> locations of straight pipe, [three] <Insert number> locations of threaded fittings, [three] <Insert number> locations of welded fittings, [two] <Insert number> locations of threaded strainers, [two] <Insert number> locations of welded strainers, [three] <Insert number> locations of threaded valves, and [three] <Insert number> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 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 in paragraphs below that is not factory insulated.

C. Heat-exchanger (water-to-water for domestic water heating service) insulation shall be the following:

D. Steam-to-hot-water converter insulation shall be the following:

E. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be [one of] the following:
   1. Flexible Elastomeric: [1 inch] <Insert thickness> thick.

F. Domestic hot-water storage tank insulation shall be [one of] the following, of thickness to provide an R-value of [12.5] <Insert value>:
   1. Mineral-fiber pipe and tank.

G. Domestic water storage tank insulation shall be [one of] the following:
   1. Flexible Elastomeric: [1 inch] <Insert thickness> thick.

H. Piping system filter-housing insulation shall be [one of] the following:

3.15 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable pipe insulation materials and thicknesses are identified for each piping system and pipe size range.
   1. [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. Chrome-plated pipes and fittings.
2. [Underground piping].
3. Drainage piping located in crawl spaces.

3.16 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be [one of] the following:
2. NPS 1 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   b. Flexible Elastomeric: 1/2 inch thick.
   c. Polyolefin: 1/2 inch thick.

3. NPS 1-1/4 and Larger: Insulation shall be [one of] the following:
4. NPS 1-1/4 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Polyolefin: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1 and Smaller: Insulation shall be [one of] the following:
2. NPS 1 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   b. Flexible Elastomeric: 1/2 inch thick.
   c. Polyolefin: 1/2 inch thick.

3. NPS 1-1/4 and Larger: Insulation shall be [one of] the following:
4. NPS 1-1/4 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Polyolefin: 1 inch thick.

C. Overflow Storm Water:

1. All Pipe Sizes: Vertical line up to drain body and all piping to point of building exit insulation shall be [one of] the following:
2. All Pipe Sizes: Vertical line up to drain body and all piping to point of building exit insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

D. Storm Water:
1. All Pipe Sizes: Vertical line up to drain body and horizontal runs within 30 Feet of drain body insulation shall be one of the following:

2. All Pipe Sizes: Vertical line up to drain body and horizontal runs within 30 Feet of drain body insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

2. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

F. Roof Drain and Overflow Drain Pans:

1. All Pipe Sizes: Insulation shall be one of the following:

2. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

H. Condensate and Equipment Drain Water below 60 Deg F(16 Deg C) Located in Ceiling Space:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch(25 mm) thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.

I. [Floor Drains, Traps, and Sanitary Drain Piping ]within 20 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg FLocated in Ceiling Space:

1. All Pipe Sizes: Insulation shall be one of the following:

2. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Polyolefin: 1 inch thick.

J. Hot Service Drains:

K. Hot Service Vents:
3.17 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 thick.
      b. Flexible Elastomeric: 2 inches thick.
      c. Polyolefin: 2 inches 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 thick.
      b. Flexible Elastomeric: 2 inches thick.
      c. Polyolefin: 2 inches 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 thick.

3.18 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

3.19 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. Pipe Fittings with Mineral Fiber Insulation:
   1. PVC Fitting Covers: 20 mils thick, white.
   2. PVC Fitting Covers: 30 mils thick, white.

D. Exposed Vertical Piping within 8 feet of Floor:
   1. PVC: 30 mils thick, white.
   2. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

3.20 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:
1. Cover flexible elastomeric insulation with [one of] the following:
   a. Adhere 10 x 10 woven mesh using insulation manufacturer’s recommended adhesive and finish with two coats of manufacturer’s recommended finish.
   b. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

2. Cover mineral fiber insulation with [one of] the following:
   a. Self-adhesive outdoor jacket with aluminum foil facing.
   b. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

D. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

E. If more than one material is listed, selection from materials listed is Contractor’s option.

F. Piping:
   1. Cover flexible elastomeric insulation with [one of] the following:
      a. Adhere 10 x 10 woven mesh using insulation manufacturer’s recommended adhesive and finish with two coats of manufacturer’s recommended finish.
      b. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.
   2. Cover mineral fiber insulation with [one of] the following:
      a. Self-adhesive outdoor jacket with aluminum foil facing.
      b. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

3.21 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 0700
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes domestic water piping inside the building.
B. This Section includes domestic water piping and water meters inside the building.
   1. Water meters will be furnished and installed by utility company.
   2. Water meters will be furnished by utility company for installation by Contractor.
C. Related Sections include the following:
   1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.
   2. Division 22 Section "Water Based Fire Suppression Systems" for water-service piping to the point where it enters the building.
   3. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
   4. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For water meters.

1.4 INFORMATIONAL SUBMITTALS

B. Field quality-control test reports.
1.5 QUALITY ASSURANCE

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

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.

1.6 REGULATORY REQUIREMENTS

A. Comply with the provisions of the following:

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Schedule 40, galvanized. Include ends matching joining method.
   6. Steel-Piping, Grooved-End Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
      a. Grooved-End-Pipe Couplings: AWWA C606, for steel-pipe dimensions. Include galvanized ferrous housing sections, gasket suitable for domestic water, and bolts and nuts.
      b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K, water tube, annealed temper.


B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.


2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
   a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for domestic water, and bolts and nuts.
   b. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) Victaulic Company of America.
   c. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Anvil International, Inc.
      2) Victaulic Company of America.
      3) Tyco/Grinnell.
      4) Shurjoint Piping Products.

2.4 PEX TUBE AND FITTINGS

A. PEX Distribution System: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engle method, manufactured in accordance with ASTM F876 and ASTM F877.

1. Fittings: ASTM F1960 metal cold expansion or ASTM F 1807, metal insert and crimp rings.

2. Pressure/Temperature Rating: Minimum 100 psig and 180 deg F.

3. [Provide pre-insulated PEX for underslab applications].

2.5 MECHANICAL JOINT COPPER PRESS FITTING SYSTEM

A. At the Installer’s option, mechanical joint copper press fitting system using Type L copper tubing may be used for 4 inch and smaller above ground domestic water systems in lieu of soldered or threaded connections as specified.

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B. Provide manufacturer’s standard mechanical joint copper press fittings and couplings which are suitable for the temperature range and operating pressures specified for each system and have the approval of state and local codes having jurisdiction.

C. Fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for fittings shall be EPDM.

D. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   1. Ridgid/Viega “ProPress”
   2. NIBCO “Press”
   3. Apollo “Xpress”

2.6 VALVES

A. General-duty valves are specified in Division 22 Section “General-Duty Valves for Plumbing Piping.”

B. Balancing and drain valves are specified in Division 22 Section “Domestic Water Piping Specialties.”

2.7 WATER METERS

A. Displacement-Type Water Meters NPS 2 and Smaller: AWWA C700, nutating-disc totalization meter with bronze case and 150-psig minimum working-pressure rating; with registration in gallons or cubic feet as required by utility; and with threaded end connections.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABB.
      b. Badger Meter, Inc.
      c. Carlon Meter Company Inc.
      e. Mueller Company.
      f. Schlumberger Limited; Water Div.
      g. Venture Measurement.

B. Turbine-Type Water Meters: AWWA C701, totalization meter with 150-psig minimum working-pressure rating; with registration in gallons or cubic feet as required by utility; and with the following end connections:

   1. NPS 2 and Smaller: Threaded.
   2. NPS 2-1/2 and Larger: Flanged.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABB.
      b. Badger Meter, Inc.
      c. Hays Fluid Controls.
e. Master Meter, Inc.
f. McCrometer.
g. Mueller Company.
h. Schlumberger Limited; Water Div.
i. SeaMetrics Inc.
j. Venture Measurement.

C. Compound-Type Water Meters NPS 3 and Larger: AWWA C702, totalization meter with integral main-line and bypass meters, bronze case, and 150-psig minimum working-pressure rating; with registration in gallons or cubic feet as required by utility; and with flanged end connections.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABB.
   b. Badger Meter, Inc.
   d. Master Meter, Inc.
   e. Mueller Company.
   f. Schlumberger Limited; Water Div.

D. Fire-Service Water Meters: AWWA C703 and UL-listed, totalization meter with 175-psig minimum working-pressure rating; with registration in gallons or cubic feet as required by utility; and with the following end connections:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Badger Meter, Inc.
   c. Mueller Company.
   d. Schlumberger Limited; Water Div.

4. Proportional, Detector-Type Water Meters: With meter on bypass.
   a. Bypass Meter: AWWA C701, turbine or AWWA C702, compound type with bronze case; size not less than one-half nominal size of main-line meter.

5. Turbine-Type Water Meters: With strainer and with meter on bypass.
   a. Strainer: Full size, matching water meter.
   b. Bypass Meter: AWWA C701, turbine type with bronze case; not less than NPS 2.

E. 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.

F. 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.
PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPE AND FITTING APPLICATIONS

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 may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Facility Water Distribution Piping."

E. Under Building Slab Domestic Water Piping from Trap Primers to Floor Drains:
   1. PEX Tube; fittings for PEX tube; and crimped joints.

F. Under Building Slab Domestic Water Piping to Island Sinks:
   1. Pre-Insulated PEX Tube; fittings for PEX tube; and crimped or cold expansion joints.

G. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 2 and Smaller: Use any of the following piping materials for each size range:
   1. Soft copper tube, Type K; copper pressure fittings; and soldered joints.
   2. PEX Tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.
   3. Provide pre-insulated PEX for underslab applications to fixtures.

H. Aboveground Domestic Water Piping At Servery Equipment: Use the following piping materials for each size range:
   1. NPS 1/2 and Smaller: Soft copper tube, Type L; copper pressure fittings; and soldered, flared, or compression joints.

I. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
   1. NPS 1/4 and Smaller for Dishwasher, Coffee Maker, and Refrigerator Final Connection: Soft copper tube, Type L; copper fittings; and soldered or compression joints.
   2. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
   3. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
   4. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
   5. NPS 2-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
6. NPS 3: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
7. NPS 4: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
8. NPS 2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
9. NPS 2-1/2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
10. NPS 3: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
11. NPS 4: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
12. NPS 4 to NPS 6: Galvanized steel pipe with grooved ends; galvanized steel-piping, grooved-end fittings; galvanized grooved-end-pipe couplings; and grooved joints.
13. NPS 8: Galvanized steel pipe with grooved ends; galvanized steel-piping, grooved-end fittings; galvanized grooved-end-pipe couplings; and grooved joints.
14. NPS 10 and NPS 12: Galvanized steel pipe with grooved ends; galvanized steel-piping, grooved-end fittings; galvanized grooved-end-pipe couplings; and grooved joints.
15. NPS 4 to NPS 6: Galvanized steel pipe; galvanized gray-iron, threaded fittings; and threaded joints.
16. NPS 8: Galvanized steel pipe; galvanized gray-iron, threaded fittings; and threaded joints.
17. NPS 10 and NPS 12: Galvanized steel pipe; galvanized gray-iron, threaded fittings; and threaded joints.

J. At Installer’s option for aboveground domestic water piping, install Type L, drawn copper tube with mechanical joint copper press fittings for pipe sizes 4 inches and smaller.

1. Valves with bodies meeting requirements of Section “General Duty valves for Plumbing Piping” may be used in mechanical joint copper press systems

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, on each water supply to plumbing fixtures that do not have supply stops and on each water supply to plumbing fixtures that do have supply stops but where take off from main or branch is not in the same room.

D. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures
that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

E. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

F. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install shut-off valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Include a backflow preventer as required by local authority having jurisdiction.

E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Press Connections: Copper press fitting connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the
tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

E. PEX Piping Joints: Join according to ASTM F 1807 or ASTM F1960.

### 3.6 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter connection according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to utility's requirements. Sub-metering may be needed in certain situations, consult with WMU.

1. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
2. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
3. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
4. Install fire-service water meters with shutoff valves on water-meter inlet and outlet and on full-size valved bypass around meter. Support meter, valves, and piping on brick or concrete piers.
5. Install remote registration system according to standards of utility and of authorities having jurisdiction.

### 3.7 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 4: 12 feet with 5/8-inch rod.
2. NPS 5: 12 feet with 3/4-inch rod.
3. NPS 6: 12 feet with 3/4-inch rod.
4. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 4: 10 feet with 1/2-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.9 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

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.
5. Remove plugs used during testing of piping and plugs used 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 domestic water piping before using.
2. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
3. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
WMU Design Guidelines

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:
   
   1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
   2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 22 1116
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Calibrated balancing valves.
4. Temperature-actuated water mixing valves.
5. Expansion Tanks
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Roof hydrants.
11. Drain valves.
12. Water hammer arresters.
13. Trap-seal primer valves.
14. Trap-seal primer systems.
15. Solenoid Valves.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers and pressure gages in domestic water piping.
2. Division 22 Section "Meters and Gages for Plumbing Piping" for flow meters, thermometers [and pressure gages] in domestic water piping.
3. Division 22 Section "Sanitary Waste Piping Specialties" for trap seal protection device.
4. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
5. Division 22 Section "Domestic Water Piping" for water meters.
6. Division 22 Section "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
7. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
8. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.
9. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

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 test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance as required by authorities having jurisdiction:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
   3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Spill-Resistant Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
3. Operation: Continuous-pressure applications.
4. Accessories:
   a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Co.
      b. Conbraco Industries, Inc.; Apollo Valves.
      c. FEBCO; SPX Valves & Controls.
      e. Zurn Plumbing Products Group; Wilkins Div.

   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
   5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Accessories:
      a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

B. Beverage-Dispensing-Equipment Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      c. Zurn Plumbing Products Group; Wilkins Div.

   3. Operation: Continuous-pressure applications.

C. Double-Check, Detector-Assembly Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1048 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
7. 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.

2.3 CALIBRATED BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. ITT Industries; Bell & Gossett Div.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Tour Andersson.
   b. ITT Industries; Bell & Gossett Div.
   c. Taco, Inc.
   d. Armstrong International, Inc.
   e. Apollo Valves.

3. Type: Ball valve with two readout ports and memory setting indicator.
5. Size: Same as connected piping, but not larger than NPS 2.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo/Conbraco Industries, Inc.
   b. Powers; a Watts Industries Co.
   d. Zurn Plumbing Products Group; Wilkins Div.
   e. Lawler Manufacturing Company, Inc.
   f. Cash Acme.
   g. Honeywell Water Controls.
h. Leonard Valve Company.

4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Type: [Cabinet-type], thermostatically controlled water mixing valve.
7. Connections: Threaded union inlets and outlet.
8. Accessories: Manual temperature control, dial thermometer, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
10. Tempered-Water Setting: <Insert deg F.>
11. Valve Finish: [Chrome plated].
12. Valve Finish: [Polished, chrome plated].
14. Piping Finish: [Chrome plated].
15. Piping Finish: Copper.

B. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leonard Valve Company.
   b. Powers; a Watts Industries Co.
   c. Symmons Industries, Inc.
2. Description: Factory-fabricated, [cabinet-type] [exposed-mounting], 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. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
11. Tempered-Water Setting: <Insert deg F.>
12. Unit Tempered-Water Design Flow Rate: <Insert gpm.>
14. Selected Unit Flow Rate at 45-psig Pressure Drop: <Insert gpm.>
15. Unit Pressure Drop at Design Flow Rate: <Insert psig.>
16. Unit Tempered-Water Outlet Size: <Insert NPS> end connection.
17. Unit Hot- and Cold-Water Inlet Size: <Insert NPS> end connections.
18. Thermostatic Mixing Valve and Water Regulator Finish: [Chrome plated] [Polished, chrome plated] [Rough bronze].
19. Piping Finish: [Chrome plated] [Copper].

C. Individual-Fixture, Water Tempering Valves:

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo/Conbraco Industries, Inc.
   b. Powers; a Watts Industries Co.
   d. Zurn Plumbing Products Group; Wilkins Div.
   e. Lawler Manufacturing Company, Inc.
   f. Cash Acme.
   g. Honeywell Water Controls.
   h. Leonard Valve Company.

5. Pressure Rating: 125 psig minimum, unless otherwise indicated.
7. Body: Bronze body with corrosion-resistant interior components[, and dial thermometer].
8. Temperature Control: Adjustable.
9. Inlets and Outlet: Threaded with integral check valves.
10. Finish: Rough or chrome-plated bronze.
11. Tempered-Water Setting: 110 deg F.

D. Emergency Shower and Eye-Wash Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo/Conbraco Industries, Inc.
   b. Powers; a Watts Industries Co.
   d. Zurn Plumbing Products Group; Wilkins Div.
   e. Lawler Manufacturing Company, Inc.

4. Pressure Rating: 125 psig minimum, unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
7. Inlets and Outlet: Threaded with integral check stops.
8. Finish: Rough or chrome-plated bronze.
9. Tempered-Water Setting: 85 deg F.
2.5 EXPANSION TANKS

A. For water heater domestic hot water system, provide bladder type expansion tank of size and capacity as indicated, with precharged air cushion, heavy duty rubber bladder, charging valve, and rust resistant finish. Watts or equivalent.

B. For heat exchanger domestic hot water systems, provide diaphragm type vertical ASME rated steel expansion tank of size and capacity as indicated, with precharged air cushion, heavy duty rubber diaphragm, charging valve, and rust resistant finish. Amtrol or equivalent.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

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

1. Ames.
2. Apollo.
3. Watts.
4. Mueller
5. Wilkins.

B. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2(DN 65) and larger.
3. Body: Bronze for NPS 2 and smaller [cast iron for NPS 2-1/2(DN 65) and larger].
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2(DN 65) and larger.
5. End Connections: Threaded for NPS 2 and smaller [flanged for NPS 2-1/2(DN 65) and larger].
6. Screen: Stainless steel with round perforations, unless otherwise indicated.
7. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.
8. Drain: Pipe plug for NPS 2 and smaller; Factory-installed, hose-end drain valve for NPS 2-1/2 and larger.

2.7 OUTLET BOXES

A. Ice Maker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.

B. Clothes Washer Outlet Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Engineering Company. [[SS ONLY]]
   b. Guy Gray Manufacturing Co., Inc. [[STEEL ONLY]]
   c. IPS Corporation. [[SHOWS GUY GRAY BOXES]]
   d. LSP Products Group, Inc. [[STEEL AND PLASTIC]]
   e. Oatey. [[STEEL AND PLASTIC]]
   f. Plastic Oddities; a division of Diverse Corporate Technologies. [[PLASTIC]]
   g. Sioux Chief Manufacturing Company, Inc. [[PLASTIC]].


3. Material and Finish: [Enameled-steel or epoxy-painted-steel] [Enameled-steel or epoxy-painted-steel or plastic] [Plastic] [Stainless-steel] box and faceplate.

4. Faucet: Separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.

5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.

6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.

2.8 HOSE BIBBS

A. Close Coupled Wall Hydrant (Hose Bibb):

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. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group.

2. Basis of Design: Woodford B75.


4. Operation: Loose key.


6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

7. Box: Slim, flush mounting with cover.

8. Box and Cover Finish: Chrome plated.

9. Operating Keys(s): One with each wall hydrant.

B. Hose Bibbs:


4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.

5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

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

2.9 WALL HYDRANTS

A. Nonfreeze Wall Hydrants (NFWH):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Woodford Manufacturing Company.

2. 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. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.

7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4 or NPS 1.
11. Box and Cover Finish: Rough brass
12. Box and Cover Finish: [Polished nickel bronze].
13. Box and Cover Finish: [Chrome plated].
15. Nozzle and Wall-Plate Finish: [Polished nickel bronze].
16. Nozzle and Wall-Plate Finish: [Rough bronze].
17. Operating Keys(s): [One] [Two] with each wall hydrant.
18. Operating Keys: Two with each wall hydrant.
2.10 ROOF HYDRANTS

A. Nonfreeze Roof Hydrants (NFRH):
   1. Manufacturers: Subject to compliance with requirements, provide products by Woodford Manufacturing Company or equivalent.
   3. Operation: Lever handle.
   5. Inlet: NPS 1.
   8. Hydrant Support: Cast iron with underdeck flange, mounting bolts, and well seal boot.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
   2. Pressure Rating: 400-psig 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:
   2. Pressure Rating: Class 125.
   5. Inlet: NPS 3/4 threaded or solder joint.
   6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.12 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIFAB, Inc.
      c. Tyler Pipe; Wade Div.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.
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DOMESTIC WATER PIPING SPECIALTIES

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3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.13 TRAP PRIMERS

A. Refer to Section 22 1319 “Sanitary Waste Piping Specialties” for p-trap type trap primers below lavatories and sinks where indicated.

B. Under-Lav Trap Primer Valve Assembly: Automatic trap primer valve type, ASSE 1018, chrome plated bronze body with o-ring seals, vacuum breaker ports, 1/2 inch threaded ends, with chrome plated special angle stop, discharge tubing and escutcheon plate. Precision Plumbing Products “Prime-Rite Under-Lav” or equivalent.

C. Inline Flow Through Trap Primer: Water supply fed inline flow through type, ASSE 1018, bronze body with atmospheric vented drain chamber, rough bronze finish, with 1/2 inch threaded or union solder ends. Watts Series A200 or equivalent.

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.

D. Automatic Valve Trap Primer: Automatic trap primer valve type, ASSE 1018, bronze body with o-ring seals, vacuum breaker ports, 1/2 inch threaded ends and optional air gap supply. Precision Plumbing Products “Prime-Rite” or equivalent.

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. P-Trap Trap Primer: ASSE 1044, p-trap type trap primer, chrome plated bronze with ground joint outlet, threaded wall tube, slip joint nuts, washers, escutcheons, 1/2 inch primer tube with compression fittings. Jay R. Smith “Prime-EZE” Model 2698 or equivalent.

2.14 TRAP-SEAL PRIMER VALVES

A. Single Supply-Type, Trap-Seat Primer Valves (TP-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
b. PPP Inc.
c. Sioux Chief Manufacturing Company, Inc.
e. Watts Industries, Inc.; Water Products Div.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Manufacturer: Subject to compliance with requirements, provide trap-seal primer system by the following:
   a. PPP Inc.

B. Trap-Seal Primer System:
   1. Standard: ASSE 1044,
   2. Piping: ASTM B 88, Type L; copper, water tubing.
   3. Cabinet: Surface-mounting steel box with stainless-steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
   7. Size Outlets: 3/4 inch.

C. Multiple Supply-Type, Trap-Seal Primer Valves (TP-2):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PPP Inc. or equivalent

2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems (TP-3):
   1. Basis-of-Design Product: Subject to compliance with requirements, provide PPP Inc. “Mini-Prime” surface mount electronic trap primer or a comparable product.
   2. Standard: ASSE 1044,
   3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
7. Number Outlets: [Two] [Three] [Four].

2.17 TRAP-SEAL PRIMER SYSTEMS
A. Trap-Seal Primer Systems (TP-4):
1. Basis-of-Design Product: Subject to compliance with requirements, provide PPP Inc. “Prime-Time” electronic trap priming manifold or a comparable product.
2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinets in Mechanical Rooms: Surface-mounting steel box with cover.
5. Cabinets in Finished Spaces: Recessed-mounting steel box with cover.
6. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
8. Number Outlets: As required for location.

2.18 DOMESTIC WATER SOLENOID VALVES
A. Provide 24 VDC operated NSF certified bronze or stainless steel solenoid valves for domestic water shut-off at cell pod main lines and at security mop basins.
1. Valves will be controlled by local security system panel. Coordinate actuator with security system supplier.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Install two backflow preventors in parallel for building water service.
2. Locate backflow preventers in same room as connected equipment or system.
3. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
4. Do not install bypass piping around backflow preventers.
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C. Install calibrated balancing valves in locations where they can easily be adjusted.

D. Install primary temperature-actuated water mixing valves in accordance with manufacturer's requirements, and with shutoff valves on inlets and with shutoff valve on outlet.

E. Install primary manifold temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each inline pump and elsewhere as indicated.

G. Install Y-pattern strainers for water on supply side of each inline pump and elsewhere as indicated.

H. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and inline pump.

I. Install individual water tempering valves at each connection to barrier-free lavatories and sinks in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.

J. Install individual water tempering valves at each connection to emergency showers and eye washes in accordance with manufacturers’ recommendations and in compliance with the plumbing code and authority having jurisdiction.

K. Install water hammer arresters in water piping according to PDI-WH 201.

L. Install trap primers in accessible location with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to trap, or inlet fitting. Adjust valve for proper flow.

M. 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.

N. 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.

O. 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.

P. Install hose bibs with vacuum breaker on wall.

Q. Install nonfreeze wall hydrants with valve body within building, not within outside wall.

R. Install nonfreeze roof hydrants with valve body within building, securely mounted to roof structure.

S. Install expansion tanks at water heaters per manufacturers recommendations after piping has been pressure tested.
T. Install vacuum breakers at each connection to commercial laundry equipment in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected and so they are easily accessible for maintenance and periodic testing.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. Install domestic water solenoid valves where indicated in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
   2. Test each domestic water piping specialty according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable flow set points of calibrated balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 1123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic water circulation:

1.2

1. In-line centrifugal booster pumps.
2. Close-coupled, in-line, centrifugal pumps.
   1. Wet rotor circulator with ECM
   2. Separately coupled, horizontally mounted, in-line centrifugal pumps.

B. Terminology used in this Section is from HI 1.1-1.2.

C. Related Sections include the following:

   1. Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.
   2. Division 33 Section "Water Supply Wells" for well pumps.

1.3 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."

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements.”

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

D. NSF Compliance as required by authorities having jurisdiction:
   2. Comply with NSF 61, “Drinking Water System Components - Health Effects; Sections 1 through 9.”

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 size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 IN-LINE CENTRIFUGAL PUMPS

A. [Manufacturers]:
1. Bell & Gossett.
2. Armstrong Pumps Inc.
3. Grundfos Pumps Corp.
4. Taco, Inc.

B. Basis of Design: Bell & Gossett Model NBF.

C. Description: Factory-assembled and -tested in-line horizontal system lubricated centrifugal pumps.

1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Lead-free bronze, with companion-flange connections.
4. Face Plate: Stainless steel.
5. Impeller: Corrosion-resistant material.
7. Motor: Multi-speed. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

2.3 CLOSE COUPLED, IN-LINE, CENTRIFUGAL PUMPS

A. Manufacturers:

1. Bell & Gossett.
2. Armstrong Pumps Inc.
3. Grundfos Pumps Corp.
4. Taco, Inc.

B. Basis of Design: Bell & Gossett Model PL.

C. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, centrifugal pumps.

1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze, with companion-flange connections.
3. Face Plate: Stainless steel.
4. Impeller: Corrosion-resistant material.
5. Shaft: Carbon steel.
7. Seal: Mechanical, carbon on silicon carbide.
8. Motor: Single speed, ODP, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
10. Elastomers: EPDM.

2.4 WET ROTOR INLINE PUMPS

A. Manufacturers:
1. Bell & Gossett.
2. Armstrong Pumps Inc.
3. Grundfos Pumps Corp.
4. Taco, Inc.

B. Basis of Design: Bell & Gossett Model ecocirc XL.

C. Description: Factory-assembled and -tested, wet rotor in-line pumps with ECM motor and integrated variable frequency drive.

1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Cast iron, with companion-flange connections.
3. Casing: Lead-free bronze, with companion-flange connections.
4. Impeller: Plastic or stainless steel.
5. Shaft: Stainless steel.
8. Gasket/O-Ring: EPDM.
9. All Other Wetted Parts: Stainless steel.
10. Motor Type: Electronically commutated motor/permanent magnet and includes:
    a. Class F motor insulation.
    b. Integrated motor protection against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
11. Integrated Variable Frequency Drive: Tested as one unit by the manufacturer and includes:
    a. MODBUS or BACnet connections built into the VFD as standard.
    b. Analog inputs, such as 0-10V and 4-20mA inputs built into the VFD.
12. T-Constant Operational Mode: Control will use a PI algorithm to vary the speed of the pump in order to maintain a constant temperature of the fluid media.

2.5 SEPARATELY COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:

1. Bell & Gossett.
2. Grundfos Pumps Corp.
3. Taco, Inc.
5. Aurora Pump; Pentair Pump Group (The).
6. Thrush Company, Inc.

B. Basis of Design: Bell & Gossett Series 60.
C. Description: Factory-assembled and -tested, overhung-impeller, single-stage, separately coupled, horizontally mounted, in-line centrifugal pumps as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.

1. Pump Construction: All bronze or bronze fitted.
   a. Casing: Radially split, cast iron, with threaded companion-flange connections or flanged connections.
   b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
   c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
   d. 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.
   e. Pump Bearings: Permanently lubricated ball bearings.

2. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

3. Motor: Single speed, with grease-lubricated ball bearings; and resiliently mounted to pump casing. Comply with requirements in Division 22 Section “Common Motor Requirements for Plumbing Equipment.”

2.6 [CONTROLS]

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:
   a. Honeywell International, Inc.
   b. Square D.

2. Type: Strap-on sensor for installation on hot-water circulation piping.

3. Operation of Pump: On or off.


5. Settings: Start pump at 100 deg F and stop pump at 120 deg F.

B. Timers: Electric time clock for control of hot-water circulation pump.

1. Manufacturers:
   a. Honeywell International, Inc.
   b. Intermatic, Inc.
   c. Johnson Controls, Inc.
   d. Maple Chase Company.
   e. TORK.
   f. <Insert manufacturer’s name.>

2. Type: Programmable, [seven-day] <Insert other> clock with manual override on-off switch.

3. Enclosure: Suitable for wall mounting.

4. Operation of Pump: On or off.

5. Transformer: Provide if required.

6. Power Requirement: [24 V, ac] [120 V, ac] <Insert other>.
7. Programmable Sequence of Operation: [Up to two on-off cycles each day for seven days] <Insert operational sequence>.

C. Time Delay Relay: Control for hot-water storage tank circulation pump.

1. Manufacturers:
   a. Honeywell International, Inc.
   b. Intermatic, Inc.
   c. Johnson Controls, Inc.
   d. Maple Chase Company.
   e. Square D.
   g. <Insert manufacturer's name.>

2. Type: Adjustable time delay relay.

3. Range: Up to five minutes.

4. Setting: Five minutes.

5. Operation of Pump: On or off.

6. Transformer: Provide if required.

7. Power Requirement: [24 V, ac] [120 V, ac] <Insert other>.

8. Programmable Sequence of Operation: Limit pump operation to periods of burner operation plus maximum five minutes after the burner stops.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Anamet, Inc.

2. Flex-Hose Co., Inc.

3. Flexicraft Industries.

4. Flex-Pression, Ltd.

5. Flex-Weld, Inc.

6. Hyspan Precision Products, Inc.


8. Metraflex, Inc.

9. Proco Products, Inc.

10. Tozen America Corporation.

11. Unaflex Inc.

12. <Insert manufacturer's name.>

B. Description: Corrugated, bronze inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze-welded to tubing. Include [125-psig] <Insert other> minimum working-pressure rating and ends matching pump connections.

2.8 BUILDING-AUTOMATION-SYSTEM INTERFACE

A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.
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 CONCRETE BASES

A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 22 Section "Common Work Results for Plumbing."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of 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.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

3.4 CONTROL INSTALLATION

A. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Install electric-type thermostats on hot-water return piping.

C. Install immersion-type thermostats in hot-water return piping.

D. Install timers [on wall in engineer's office] <Insert other>.
3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to 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. Refer to Division 22 Section "Domestic Water Piping."

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
   a. Separately coupled, in-line centrifugal pumps.
   b. Separately coupled, horizontally mounted, in-line centrifugal pumps.
   c. Close-coupled, horizontally mounted, in-line centrifugal pumps.
   d. Close-coupled, vertically mounted, in-line centrifugal pumps.

2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.

3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and gage connectors.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. Connect [thermostats] to pumps that they control.

G. Connect [thermostats] [thermostats and timers] [timers] to pumps that they control.

H. Interlock pump with water heater burner and time delay relay.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. 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.
5. Set [thermostats] [thermostats and timers] [timers] for automatic starting and stopping operation of pumps.
6. 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.

7. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
8. Start motor.
9. Open discharge valve slowly.
10. Adjust temperature settings on thermostats.
11. [Adjust timer settings].

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain [controls and] pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 1123
WMU Design Guidelines

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building.

B. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to a point five feet outside the building.

C. This Section includes forced main waste piping inside the building.

D. The following Sections contain related requirements:

1. Division 22 Section "General Duty Valves for Plumbing Piping" for valves in forced main piping.
2. Division 22 Section "Sanitary Waste Piping Specialties" for soil, waste, and vent piping system specialties.
3. Division 22 Section "Sanitary Sewerage Pumps" for sewage sump pumps.
4. Division 22 Section "Wastewater Sump Pumps" for elevator sump pumps.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

2. Forced Main Waste Piping: 50 psig.
3. Waste, Force-Main Piping: [50 psig] [100 psig] [150 psig] <Insert pressure>.

1.3 ACTION SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
1.4 INFORMATIONAL SUBMITTALS
   A. Field quality-control inspection and test reports.

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

1.6 REGULATORY REQUIREMENTS
   A. Comply with the provisions of the following:

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
   A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.
   B. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
   C. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 and CISPI 301.
      1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
         a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
   D. Steel Pipe: ASTM A 53/A 53M, Type E, Schedule 40, galvanized. Include ends matching joining method.
      1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
      2. Pressure Fittings:
b. Malleable-Iron Unions: ASME B16.39; Class 150, galvanized, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

E. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

F. Cellular-Core PVC Pipe: ASTM F 891, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

G. Drawn-Temper Copper Tubing: ASTM B 88, Type L.


H. PEX Tube: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.

2.2 ELEVATOR SUMP FORCED MAIN VALVES

A. PVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. IPEX.
   c. Jomar International.
   d. NIBCO Inc.
   e. Spears Manufacturing Company.
   f. Thermoplastic Valves Inc.

2. Description:
   b. Pressure Rating and Temperature: 125 psig at 73 deg F.
   c. Body Material: PVC.
   d. Body Design: Non-union type.
   e. End Connections: Socket or threaded.
   f. Ball: PVC; full port.
g. Seals: PTFE or EPDM-rubber O-rings suitable for application.
h. Handle: Tee shaped.

B. PVC Ball Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. IPEX.
   c. NIBCO Inc.
   d. Spears Manufacturing Company.
   e. Thermoplastic Valves Inc.

2. Description:
   a. Pressure Rating and Temperature: 125 psig at 73 deg F.
   b. Body Material: PVC.
   c. Body Design: Union-type ball check.
   d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
   e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
   f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, [socket] [socket or threaded] [threaded] [flanged].
   g. Ball: PVC.
   h. Seals: EPDM- or FKM-rubber O-rings suitable for application.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A.

B. Aboveground, soil, waste, and vent piping NPS 1 1/2(DN 40) and smaller shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Steel pipe, drainage fittings, and threaded joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, soil, waste, and vent piping NPS 2(DN 50) through NPS 10(DN 250) shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. PVC above ground only allowed in concealed locations.

D. Underground, soil, waste, and vent piping NPS 10(DN 250) and smaller shall be any of the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, soil and waste Piping NPS 12(DN 300) and larger shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
   2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
   3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Roof Hydrant Drain Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

G. Drain Piping from P-Trap Type Trap Primers to Floor Drains:
   1. PEX Tube and fittings with crimped joints.

H. Under-Building-Slab Trap Primer Feed:
   1. PEX Tube and fittings with crimped joints.

I. Aboveground forced main piping shall be the following:
   1. PVC solid wall pipe, PVC socket fittings, and solvent-cemented joints.
   2. Galvanized-steel pipe, pressure fittings, and threaded joints.

3.2 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. 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."

F. 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 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. 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.

   1. Below slab sanitary drains shall be minimum 3-inch (76-mm) unless otherwise indicated with reducer down to above slab pipe size located at floor line.

H. Install soil and waste drainage and vent piping at the minimum slopes required by plumbing code.

I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


   1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
   2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

   1. For indoor applications, use PVC glue that has a VOC content of 510 g/L or less.
   2. For indoor applications, use PVC primer that has a VOC content of 550 g/L or less.

D. PVC Pressure Piping Joints: Join piping according to ASTM D 2855.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
3.4 VALVE INSTALLATION

A. Shutoff Valves: Install ball valve on each elevator sump pump discharge.

B. Check Valves: Install swing check valve upstream on each elevator sump pump discharge.

3.5 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing."

B. Shutoff Valves: Install shutoff valve on each pump discharge.
   1. Use gate or full-port ball valve for piping NPS 2 and smaller.
   2. Use gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, downstream from shutoff valve, on each pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage 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. Backwater valves are specified in Division 22 Section "Domestic Water Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
C. Support vertical piping at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 10: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 10: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

K. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.

3.7 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to other Division 22 plumbing fixtures sections.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section “Sanitary Waste Piping Specialties.”
4. 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 and larger.
5. Roof Hydrant Drain: Connect to hydrant and slope to safe-waste outlet at point of disposal.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 48 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.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

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 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.
3.9 CLEANING

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

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 1316
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Trench drains.
4. Trap-seal protection devices.
5. Air-admittance valves.
6. Miscellaneous drainage piping specialties.
7. Grease interceptors.
8. Solids interceptors
10. Oil interceptors.

1.2 ACTION SUBMITTALS

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

1. Include rated capacities, operating characteristics, and accessories for oil interceptors.
2. Include rated capacities, operating characteristics, and accessories for grease and oil interceptors.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For oil interceptors, to include in operation, and maintenance manuals.

B. Operation and Maintenance Data: For grease and oil interceptors, to include in operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

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 or threaded access check valve.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

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.

2.2 CLEANOUTS

A. Exposed End of Pipe Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group.
2. **Standard:** ASME A112.36.2M.
3. **Size:** Same as connected drainage piping
4. **Body Material:** Hubless, cast-iron soil pipe as required to match connected piping.
5. ** Closure:** Countersunk, brass plug.
6. ** Closure Plug Size:** Same as or not more than one size smaller than cleanout size.

### B. Cast-Iron Floor Cleanouts:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group.
   g. Josam Company; Josam Div.

2. **Standard:** ASME A112.36.2M for adjustable housing cleanout.
3. **Size:** Same as connected branch.
4. **Type:** Adjustable housing.
5. **Body or Ferrule:** Cast iron.
6. **Outlet Connection:** Spigot.
7. **Closure:** Brass plug with straight threads and gasket.
8. **Adjustable Housing Material:** Cast iron with threads.
9. **Riser:** ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
10. **Accessible Fasteners:** Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
    a. Refer to Drawing A110.

### C. Cast-Iron Interior Finished Wall Cleanouts:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group.
g. Josam Company; Josam Div.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Accessible Fasteners: Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
a. Refer to Drawing A110.

D. Cast-Iron Interior Unfinished Accessible Area Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group.
   g. Josam Company; Josam Div.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

E. Cast-Iron Floating Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Light Commercial Operation.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout and ASME A112.6.3 for lower body.
3. Size: 3 inch (75 mm).
4. Lower Body: "Wade" 2000 or equivalent lower cast iron body with flange, integral clamping collar, and 3 inch (75 mm) plastic stand pipe.
5. Upper Cleanout: "Wade" 6000Z or equivalent cast iron body with threaded adjustable housing, flanged ferrule with round scoriated cast iron cover.
2.3 LINEAR FLOOR DRAINS

A. Manufacturers: Subject to compliance with requirements, provide FreeStyle Linear Drains as manufactured by Noble Company, Grand Haven, MI or comparable Architect/Engineer approved product.

B. Linear Drain (FD-1): One piece PVC or ABS linear drain body with sloped channel to vertical waste pipe.
   1. Clamping Ring: Stainless steel mechanism to clamp waterproof membrane to linear drain body.
   2. Strainer: Removable brushed stainless steel strainer.
      a. Style: Slotted.
   3. Length: As indicated.
   4. Flashing:
      a. Flashing membrane.
      b. Manufacturer’s recommended sealant for sealing flashing membrane to drain base.
   5. Hardware: Miscellaneous fasteners and anchors as required by manufacturer’s installation instructions.

2.4 FLOOR DRAINS

A. Cast-Iron Floor Drains - General:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIFAB, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group.
      g. Josam Company; Josam Div.
   2. Standard: ASME A112.6.3.
   3. Accessible Fasteners: Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
      a. Refer to Drawing A110.

B. Cast Iron Floor Drains: Coated gray iron body having integral double drainage flange with weep holes and no-hub spigot or push-on bottom outlet. Provide flashing clamp device where located in membrane floor or when flashing is required for pans. Floor drain type designations and sizes are indicated on Drawings and scheduled below:
1. **FD-1:** Toilet rooms and finished areas not specifically noted, "Wade" 1100STD6 or equivalent with [6 inch (150 mm) round] nickel bronze top.

2. **FD-1:** Toilet rooms and finished areas not specifically noted, "Wade" 1100G6 or equivalent with 6 inch [150 mm] square nickel bronze top.

3. **FD-3:** Funnel type drains, finished areas, "Wade" 1100STD6-EF4 or equivalent with [6 inch] round nickel bronze top and 4 inch round funnel.

4. **FD-2:** Mechanical room, receiving and storage room, "Wade" 1310TD or equivalent with 9 inch round ductile iron top and sediment bucket.

5. **FD-3:** Mechanical Room Floor sink, "Wade" 9110 8” x 8” x 6” or equivalent with removable cast iron grate, cast iron body and aluminum dome strainer at outlet.

6. **FD-4:** Single shower drain, "Wade" 1100-G5 or equivalent with 5 inch square nickel bronze top.

7. **FD-7:** Kitchen floor sink, "Wade" 9140 12” x 12” x 8” or equivalent with cast iron body, A.R.E. interior, and aluminum dome strainer at outlet, 3/4 grate.

8. **FD-8:** Gang Shower drain, "Wade" 1100H or equivalent with 4” x 12” rectangular nickel bronze top, seepage openings and clamping collar.

9. **FD-9:** Boiler Room, "Wade" 1310TD or equivalent with 9 inch round ductile iron top and sediment bucket.

10. **FD-10:** Boiler Blowdown Drain, "Wade" 2374 or equivalent square cast iron floor drain with secondary dome strainer, less grate.

11. **FD-11:** Greenhouse and Potting Room, "Wade" 1310TD or equivalent with 9 inch round ductile iron top and sediment bucket.

12. **FD-12:** Floor Mat Drains, "Wade" 1310TD or equivalent with 9 inch round ductile iron top and sediment bucket.

13. **FD-13:** Floating floors (isolation type drains) "Wade" 2000 or equivalent lower cast iron body with flange, integral clamping collar, and 3 inch plastic stand pipe; and "Wade" 1310TD or equivalent upper floor drain with 9 inch round ductile iron top and sediment bucket.

14. **FD-14:** Areaway drain, "Wade" W-3220PA or equivalent cast iron area drain with flashing ring and dome with brass screen. Provide 24" x 24" x 6” concrete pad around drain.

15. **FD-15:** Drain in commercial laundry trench, "Wade" W-3220PA or equivalent cast iron area drain with flashing ring and dome with brass screen.

16. **FD-16:** Flushing rim drain, "Wade" 9300 or equivalent with flange, white porcelain coated interior, flushing connection, and nickel bronze secured vandal proof grate.

2.5 **TRENCH DRAINS**

**A. Channel Drainage Systems (TD-1):**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ACO Polymer Products, Inc.
   b. NDS Inc.
   c. Josam Company; Mea-Josam Div.
   e. Zurn Plumbing Products Group; Flo-Thru Operation.

2. Type: Prefabricated modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
   a. Material: HDPE, Polymer-Concrete, PE, or FRP.
b. Channel Sections: Interlocking-joint, modular units, with end caps and rounded, sloped bottom.
   1) Dimensions: Minimum 6 inches wide. Include number of units required to provide a nominal total length of 13'-6".

c. Grates: With slots, and widths and thickness that fit recesses in channel sections.
   1) Material: Black epoxy coated cast iron.
   2) Load Rating: Heavy duty.
   3) Material: [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel] <Insert material>.
   4) Color: <Insert color or delete subparagraph.>

d. Catch Basin: Single piece with black epoxy cast iron grate and side outlet.
   1) Dimensions: Nominal 12 inches by 20 inches by 24 inches deep.

e. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

f. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 TRAP SEAL PROTECTION DEVICES

A. Barrier Type Trap Seal Protection Devices:
   1. Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer or Jay R. Smith Model 2692 Trap Seal.
   3. Size: 2 inch thru 4 inch as required

B. Barrier Type Trap Seal Protection Devices:
   1. Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer, or a comparable product by one of the following:
      a. <Insert manufacturer's name>.
   4. Body: ASB Plastic
   5. Diaphragm & Sealing Gasket: Neoprene Rubber
   6. Size: 2 inch thru 4 inch as required
   7. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

2.7 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:
   1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
   3. Operation: Mechanical sealing diaphragm.
   4. Size: Same as connected fixture or branch vent piping.
B. Stack Air-Admittance Valves <Insert drawing designation if any>:

C. Wall Box <Insert drawing designation if any>:

2.8 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from specified soil-pipe fittings. Include P-trap, riser section; and where required, increaser fitting.
   2. Size: Same as connected waste piping[with increaser fitting of size indicated].

B. Deep-Seal Traps:
   1. Description: Cast-iron casting, with inlet and outlet matching connected piping and plugged trap-seal primer connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch- minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:
   1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:
   1. Description: Counterflash-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.
2.9 GREASE INTERCEPTORS

A. Grease Interceptors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Highland Tank.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Rockford Sanitary 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; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.


3. Body Material: Cast iron or steel.

4. Interior Lining: Corrosion-resistant enamel.

5. Exterior Coating: Corrosion-resistant enamel.


7. Mounting: [Above floor] [Recessed, flush with floor].

8. Flow-Control Fitting: Required.

2.10 KITCHEN GREASE INTERCEPTOR

A. Provide 1000 gallon underground concrete tank designed for use as a kitchen grease interceptor as indicated, in accordance with health department regulations. Provide with inlet, outlet, and vent connections, baffle plate, and two manholes.

2.11 SOLIDS INTERCEPTORS

A. Solids Interceptors, Fixture Trap Type, Bottom Access:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Rockford Sanitary Systems, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Type: Factory-fabricated interceptor made for removing and retaining solids from wastewater.

3. Body Material: Cast iron or steel.


5. Inlet: 1-1/2 inch slip joint elbow.

B. Solids Interceptors, Floor Mounted, Top Access:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Rockford Sanitary Systems, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Type: Factory-fabricated interceptor made for removing and retaining solids from wastewater.
3. Body Material: Cast iron or steel.
5. Interior Lining: Corrosion-resistant enamel.
6. Inlet and Outlet Size: 2 inches.

2.12 OIL INTERCEPTORS

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

1. Cast Iron or Steel:
   a. Highland Tank
   b. Rockford Sanitary Systems, Inc.

2. Plastic:
   a. Green Turtle (USA).
   b. Schier Products Company.

B. Description:

1. Descriptive Type or Function: Factory-fabricated interceptor for separating and removing oil from elevator sump wastewater in accordance with State of Michigan code requirements.
2. Body Material: Plastic, stainless steel, cast iron or steel with corrosion-resistant coating.
3. Cleanout: Integral or field installed on outlet.
4. Mounting: Recessed, flush with floor. Include extension as required by field conditions.
5. Mounting: [Above floor] [Recessed in acid-resistant, coated steel frame and cradle] [Recessed, flush with floor] <Insert mounting>.
6. Flow-Control Fitting: Integral or field installed.
7. Filter: Coalescing type.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Install wall cleanouts in all finished spaces.
2. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
3. Locate at each change in direction of piping greater than 45 degrees.
4. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
5. Locate at base of each vertical soil and waste stack.
6. For cleanouts at grade within 5'-0" of building install cleanouts and extension from drain pipe to cleanout at grade where indicated. Set cleanout in poured concrete block 18 inches by 18 inches by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.
7. Align square tops parallel with building walls.

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 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 or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
5. Align square tops parallel with floor tile.

G. Assemble [trench drainage ] system components according to manufacturer’s written instructions. Install on support devices so that top will be flush with adjacent surface.

H. Install trap-seal protection devices at floor sink and floor drain outlets (omit at shower floor drains) during trim out stage of project.

I. Install fixture air-admittance valves on fixture drain piping where indicated.

J. Install stack air-admittance valves at top of stack vent and vent stack piping.

K. Install air-admittance-valve wall boxes recessed in wall.

L. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

M. Assemble open drain fittings and install with top of hub [1 inch] [2 inches] <Insert dimension> above floor.

N. Install trap primers with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to trap, or inlet fitting. Adjust for proper flow.

O. Install deep-seal traps on floor drains and other waste outlets, if indicated.

P. 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.

Q. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

R. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

S. 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. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

T. Install oil interceptors level and plumb, 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. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

U. Install solids interceptors below fixture being served in lieu of p-trap. Connect to sanitary drainage system. Locate and install to allow for access to unit and removal of integral basket.

V. Install kitchen grease interceptor as indicated, as required by the plumbing code and health department.

W. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

X. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 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.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain oil interceptors.

B. Train Owner's maintenance personnel to adjust, operate, and maintain grease and oil interceptors.

END OF SECTION 22 1319
WMU Design Guidelines

WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 1413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes storm drainage piping inside the building.

B. This Section includes storm drainage piping inside the building [and to a point five feet outside the building].

C. Related Sections include the following:

   1. Division 22 Section "Storm Drainage Piping Specialties" for storm drainage piping system specialties.
   2. Division 22 Section "Sump Pumps" for storm sump pumps.
   3. Section 33 4400 "Stormwater Utility Equipment" 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.

1.4 ACTION SUBMITTALS

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

B. LEED Submittal:

   1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
1.5 INFORMATIONAL SUBMITTALS
   A. Field quality-control inspection and test reports.

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

1.7 REGULATORY REQUIREMENTS
   A. Comply with the provisions of the following:

1.8 FIELD CONDITIONS
   A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
      1. Notify Construction Manager no fewer than two days in advance of proposed interruption of storm drainage service.
      2. Do not proceed with interruption of storm drainage service without Construction Manager's written permission.
      3. Notify [Architect] [Construction Manager] [Owner] no fewer than [two] days in advance of proposed interruption of storm drainage service.
      4. Do not proceed with interruption of storm drainage service without [Architect's] [Construction Manager's] [Owner's] written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
   A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.
   B. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
      2. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
   C. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 and CISPI 301.
      1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.


D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Pressure Fittings:
   b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
   e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125[, galvanized].

E. DUCTILE-IRON PIPE AND FITTINGS

F. COPPER TUBE AND FITTINGS

G. ABS PIPE AND FITTINGS

H. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

I. Cellular-Core PVC Pipe: ASTM F 891, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

J. Adhesive Primer: ASTM F 656.

2.2 SPECIALTY PIPE FITTINGS

2.3 ENCASEMENT FOR UNDERGROUND METAL PIPING

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 “Earth Moving.”

3.2 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. [Install cleanouts at grade ]and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section “Storm Drainage Piping Specialties.”

D. [Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration ]through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install wall-penetration-fitting system at each service pipe penetration through foundation wall. Make installation watertight.

F. 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."

G. Make changes in direction for storm 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.

H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer’s written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install storm drainage piping at the minimum slopes required by plumbing code.
J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. [Install above slab PVC ]storm drainage piping according to ASTM D 2665.

L. [Install underground PVC ]storm drainage piping according to ASTM D 2321.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Paint interiors of PVC overflow roof drain piping for 24 inches upstream of outlet fitting. Apply one coat of flat black latex finish. Paint materials and application requirements are specified in Division 09 painting Sections.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

   1. For indoor applications, use PVC glue that has a VOC content of 510 g/L or less.
   2. For indoor applications, use PVC primer that has a VOC content of 550 g/L or less.

3.4 SPECIALTY PIPE FITTING INSTALLATION

3.5 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

   1. Use gate or full-port ball valve for piping NPS 2 and smaller.
   2. Use gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, downstream from 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. Install backwater valves in accessible locations.
3. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment.” Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls.
   Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment.”

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 10: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 10: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 48 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.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Aboveground storm drainage piping NPS 2(DN 50) through NPS 10(DN 250) shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. PVC above ground only allowed in concealed locations.

B. Underground storm drainage piping NPS 10(DN 250) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Underground, storm drainage piping NPS 12(DN 300) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 1413
WMU Design Guidelines

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SECTION 22 1423 - 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. This Section includes the following storm drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Roof drains.
4. Trench drains.
5. Miscellaneous storm drainage piping specialties.

B. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
2. Section 07 8413 "Penetration Firestopping" for firestopping roof penetrations.

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 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
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 or threaded access check valve.


7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.

8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

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

2. MIFAB, Inc.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.
7. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Exposed End of Pipe Cast-Iron Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe as required to match connected piping.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Cast-Iron Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Spigot.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
9. Accessible Fasteners: Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
   a. Refer to Drawing A110.

10. Frame and Cover Type:
   a. Ceramic, Mosaic & Quarry Tile Floors: Terrazzo top type with square nickel bronze top.
   b. Asphalt & Vinyl Tile Floors: Tile top type with square nickel bronze top.
   c. Terrazzo Floors: Terrazzo top type with round nickel bronze top.
   d. Carpet Floors: Carpet flange type with round nickel bronze top.
   e. Other Finished Floors: Heavy duty type with round nickel bronze top.
   f. Unfinished Concrete Floors: Heavy duty type with round cast iron top.

D. Cast-Iron Interior Finished Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Accessible Fasteners: Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
   a. Refer to Drawing A110.

E. Cast-Iron Interior Unfinished Accessible Area Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Accessible Fasteners: Tamper resistant, except in inmate occupied areas provide security pin type fasteners.
   a. Refer to Drawing A110.

F. Cast-Iron Floating Floor Cleanouts:
1. Standard: ASME A112.36.2M for adjustable housing cleanout and ASME A112.6.3 for lower body.
2. Size: 3 inch (75 mm).
3. Lower Body: "Wade" 2000 or equivalent lower cast iron body with flange, integral clamping collar, and 3 inch (75 mm) plastic stand pipe.
4. Upper Cleanout: "Wade" 6000Z or equivalent cast iron body with threaded adjustable housing, flanged ferrule with round scoriated cast iron cover.

2.3 ROOF DRAINS

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

2. MIFAB, Inc.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.
7. Zurn Plumbing Products Group; Light Commercial Operation.
8. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Cast-Iron Roof Drains - General:

1. Standard: ASME A112.21.2M.

C. Cast Iron Roof Drains: Coated cast iron wide flange body, flashing ring/gravel stop, standard under deck clamp and cast iron dome strainer. Provide steel bearing pan in roof decks for added bearing surface area. Roof drain type designations and sizes are indicated on drawings and scheduled below:

1. RD-1: General Roof Locations "Wade" 3000-52-53-DF or equivalent with cast iron dome, bearing pan, deck clamp, and extension flange.
   a. Coordinate height of required extension flange with insulation thickness at each roof drain.

1. RD-2: Overflow Drain Locations W-3000-52-53-D-DF with cast iron dome, bearing pan, 2-inch (50-mm) high dam, deck clamp, and extension flange.
   a. Coordinate height of required extension flange with insulation thickness at each roof drain.

2. RD-1: Combination Roof/Overflow Drain Locations W-3042-42 with cast iron dome, bearing pan, 2-inch (50-mm) high dam, deck clamp, and extension flange.
   a. Coordinate height of required extension flange with insulation thickness at each roof drain.

D. Roof Drain Downspout Expansion Joints: "Wade 3900 Series or equivalent expansion joint for downspouts.

E. Overflow Drain Downspout Nozzles: "Wade" 3940-166 or equivalent [nickel] bronze, round with removable stainless steel screen.

F. Overflow Drain Downspout Nozzles: "Wade" 3940-166 or equivalent bronze, round with straight bottom section and mounting flange.

G. MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

H. Downspout Boots:
   1. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
   2. Size: Same as or larger than connected downspout.

I. Conductor Nozzles:
   1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
   2. Size: Same as connected conductor.

2.4 TRENCH DRAINS

A. Channel Drainage Systems (TD-1):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ACO Polymer Products, Inc.
      b. NDS Inc.
      c. Josam Company; Mea-Josam Div.
      e. Zurn Plumbing Products Group; Flo-Thru Operation.
   2. Type: Prefabricated modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
      a. Material: HDPE, Polymer-Concrete, PE, or FRP.
      b. Channel Sections: Interlocking-joint, modular units, with end caps and rounded, sloped bottom.
         1) Dimensions: Minimum 6 inches wide. Include number of units required to provide a nominal total length of 13’-6”.
      c. Grates: With slots, and widths and thickness that fit recesses in channel sections.
         1) Material: Black epoxy coated cast iron.
         2) Load Rating: Heavy duty.
         3) Material: [Fiberglass] [Galvanized steel] [Gray iron] [Stainless steel] <Insert material>.
         4) Color: <Insert color or delete subparagraph.>
      d. Catch Basin: Single piece with black epoxy cast iron grate and side outlet.
         1) Dimensions: Nominal 12 inches by 20 inches by 24 inches deep.
      e. Supports, Anchors, and Setting Devices: Manufacturer’s standard, unless otherwise indicated.
f. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section “Common Work Results for Plumbing” for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Install wall cleanouts in all finished spaces.
   2. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   3. Locate at each change in direction of piping greater than 45 degrees.
   4. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   5. Locate at base of each vertical soil and waste stack.
   6. [For cleanouts at grade within 5’-0” of building] Install cleanouts and extension from drain pipe to cleanout at grade where indicated. Set cleanout in poured concrete block 18 inches by 18 inches by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.
   7. Align square tops parallel with building walls.

D. For floor cleanouts for piping below floors in unfinished spaces or other spaces as indicated, install cleanout deck plates with top flush with finished floor.

E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

G. Install roof drains at low points of roof areas according to roof membrane manufacturer’s written installation instructions.
   1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Position roof drains for easy access and maintenance.
   3. Install expansion joints in downspouts 25 feet or more in height, where horizontal offset is less than 5 feet.
H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install cast-iron soil pipe downspout boots at grade with top of hub 6 inches above grade.

J. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

L. Assemble [trench drainage system ] components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1423
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 3100 - DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes commercial water softeners.
B. This Section includes [household][commercial] water softeners.
   1. Chemicals.
   2. Water testing kits.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   3. Wiring Diagrams: For power, signal, and control wiring.
B. Manufacturer Certificates: Signed by manufacturers certifying that water softeners comply with requirements.

1.3 INFORMATIONAL SUBMITTALS
A. Source quality-control test reports.
B. Field quality-control test reports.
C. Warranty: Special warranty specified in this Section.
D. Maintenance service agreement.

1.4 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.
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. Salt for Brine Tanks: Furnish same form as and at least the same amount as original load, but not less than 200 lb. Deliver on pallets in 40- or 50-lb packages.
2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.
3. Salt for Brine Tanks: Furnish in same form as and at least [four] times original load, but not less than [200 lb] [1000 lb]. Deliver on pallets according to the following:
   a. Food-Grade Pellet Salt: In [40- or 50-lb] [80-lb] packages.
   b. Plain Pellet Salt: In [40- or 50-lb] [80-lb] packages.
   c. Crystallized Solar Salt: In [40- or 50-lb] [80-lb] packages.
   d. Plain, Brine Block Salt: In [50-lb] blocks.

4. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water softeners and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, where indicated.

D. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.

E. NSF Compliance as required by authorities having jurisdiction:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
   3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer shall guarantee that under operating conditions, the water softening system will provide zero GPG hardness as determined by soap or titrate test; that the loss of mineral by attrition will be no greater than 3% per annum for three years and the turbidity of the treated water will be no greater than the untreated water due to the fault of the softener system.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures of mineral and brine tanks.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   d. Attrition loss of resin exceeding 3 percent per year.
   e. Mineral washed out of system during service run or backwashing period.
   f. Effluent turbidity greater and color darker than incoming water.
   g. Fouling of underdrain system, gravel, and resin, with turbidity or by dirt, rust, or scale from softener equipment or soft water, while operating according to manufacturer's written operating instructions.

2. Household Water Softener, Warranty Period: [Five] <Insert number> years from date of Substantial Completion.

3. Commercial Water Softener, Warranty Period: From date of Substantial Completion.
   a. Mineral Tanks: [Five] [10] <Insert number> years.
   b. Brine Tanks: [Three] [Five] <Insert number> years.
   c. Controls: [Five] [10] <Insert number> years.
   d. Underdrain Systems: [Three] [Five] <Insert number> years.

1.9 MAINTENANCE SERVICE

A. Maintenance: Submit [four] <Insert number> copies of manufacturer's "Agreement for Continued Service and Maintenance," before Substantial Completion, for Owner's acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing to include replacing materials and equipment. Include one-year term of agreement with option for one-year renewal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 HOUSEHOLD WATER SOFTENERS

A. [Available] Manufacturers:

1. Alamo Water Refiners, Inc.
2. CSI Water Treatment Systems; a division of Chandler Systems, Inc.
4. CUNO Incorporated.
7. Flint & Walling, Inc.; a subsidiary of Zoeller Co.
8. Ion Exchange Products, Inc.
10. Marlo, Inc.
11. Plymouth Products, Inc.
12. Rainsoft Div.; Aquion Partners L.P.
13. Springsoft Intl., Inc.
15. <Insert manufacturer's name.>

B. Description: Factory-assembled, fully-automatic, pressure-type water softener.

1. Configuration: Unit with one mineral tank and one brine tank [or cabinet-style, combination mineral and brine tank unit with equivalent characteristics].
2. Mineral Tank: Steel or FRP, with coating or liner suitable for potable-water service and [125-psig] minimum pressure rating.
3. Comply with NSF 61, "Drinking Water System Components--Health Effects."
4. Controls: For fully automatic operation.
5. Brine Tank: Combination measuring and wet-salt storing system.
   a. Tank and Cover Material: FRP or molded PE.
   b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
   c. Size: Large enough for at least two regenerations at full salting.

6. Factory-Installed Accessories:
   a. Piping, valves, tubing, and drains.
   b. Sampling cock.
   c. Main-operating-valve position indicator.

C. Capacity and Characteristics:

2. Water Analysis:
   a. Hardness: <Insert grains/gal. or ppm.>
   d. Concentration: <Insert pH.>
   e. Inlet Water Pressure: <Insert psig.>
   f. Water Temperature: <Insert deg F.>
3. Continuous Service Flow Rate: <Insert number> gpm at 15-psig pressure drop.
4. Peak Service Flow Rate: <Insert number> gpm at 25-psig pressure drop.
7. Electrical Characteristics:
   a. Volts: <Insert value.>
   b. Phases: <Insert value.>
   c. Hertz: <Insert value.>
   d. Full-Load Amperes: <Insert value.>
   e. Minimum Circuit Ampacity: <Insert value.>
   f. Maximum Overcurrent Protection: <Insert value.>

2.3 COMMERCIAL WATER SOFTENERS

A. Description: Factory-assembled, pressure-type water softener.

1. Available Manufacturers:
   a. Aquion Water Treatment Products.
   b. Canney’s Inc.
   c. Culligan International Company.
   d. Flier’s Inc.
   e. Kinetico Incorporated.
   f. Mitco Inc.
   g. Peerless, Inc.
   h. Sterling Water Treatment.

2. Comply with NSF 61, "Drinking Water System Components--Health Effects."
3. Configuration: Twin unit with two mineral tanks and one brine tank.
4. Configuration: [Single unit with one mineral tank] [Twin unit with two mineral tanks]
   [Triple unit with three mineral tanks] <Insert configuration> and one brine tank[, factory
   mounted on skids].
   b. Construction: [Non-ASME code.] [Fabricated and stamped to comply with ASME
      Boiler and Pressure Vessel Code: Section X, "Fiber-Reinforced Plastic Pressure
      Vessels."]
   c. Pressure Rating: 150 psig minimum.
   d. Pressure Rating: [100 psig] [125 psig] <Insert pressure> minimum.
   e. Wetted Components: Suitable for water temperatures from 40 to at least 100
deg F.
   f. Wetted Components: Suitable for water temperatures from [40 to at least 100
deg F] [40 to at least 120 deg F] [40 to at least 150 deg F] <Insert temperature>.
   g. Freeboard: 50 percent minimum for backwash expansion above normal resin bed
   level.
   h. Support: Legs or skirt attached to tank.
   i. Support Legs or Skirt: Constructed of structural steel, welded to tank[ before
testing and labeling].
j. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.

k. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers; arranged for even flow distribution through resin bed.

l. Liner: PE, ABS, or other material suitable for potable water.

6. Mineral Tanks: [Steel] [Stainless steel], electric welded; pressure-vessel quality.
   a. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
   b. Construction: [Non-ASME code.] [Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels." ]
   c. Pressure Rating: [100 psig] [125 psig] [150 psig] <Insert pressure> minimum.
   d. Wetted Components: Suitable for water temperatures from [40 to at least 100 deg F] [40 to at least 120 deg F] [40 to at least 150 deg F] <Insert temperature>.
   e. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
   f. Handholes: 4 inches round or 4 by 6 inches elliptical, in top head and lower sidewall of tanks 30 inches and smaller in diameter.
   g. Manhole: 11 by 15 inches in top head of tanks larger than 30 inches in diameter.
   h. Support Legs or Skirt: Constructed of structural steel, welded to tank [before testing and labeling].
   i. Finish: Hot-dip galvanized on exterior and interior of tank after fabrication unless tank is stainless steel.
   j. Finish: Exterior of tank spray painted with rust-resistant prime coat, 2- to 3-mil dry film thickness. Interior sandblasted and lined with epoxy-polyamide coating, 8- to 10-mil dry film thickness.
   k. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
   l. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers; arranged for even flow distribution through resin bed.
   m. Liner: PE, ABS, or other material suitable for potable water.

7. Controls: Automatic; factory mounted on unit and factory wired.
   a. Adjustable duration of various regeneration steps.
   b. Push-button start and complete manual operation.
   c. Electric time clock and switch for automatic operation, except for manual return to service.
   d. Sequence of Operation: Program multiport pilot-control valve to automatically pressure-actuate main operating valve through steps of regeneration.
   e. Pointer on pilot-control valve shall indicate cycle of operation.
   f. Means of manual operation of pilot-control valve if power fails.

8. Controls: Fully automatic; factory mounted on unit and factory wired.
   a. Adjustable duration of various regeneration steps.
   b. Push-button start and complete manual operation.
   c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
d. Sequence of Operation: Program multiport pilot-control valve to automatically pressure-actuate main operating valve through steps of regeneration and return to service.

e. Pointer on pilot-control valve shall indicate cycle of operation.

f. Means of manual operation of pilot-control valve if power fails.

g. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

1) Slow opening and closing, nonslam operation.
2) Diaphragm guiding on full perimeter from fully open to fully closed.
3) Isolated dissimilar metals within valve.
4) Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
5) Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
6) Sampling cocks for soft water.
7) Special tools are not required for service.

h. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressures, and that does not require field adjustments.

1) Meter Control: Equip each mineral tank with signal-register-head water meter that will produce electrical signal indicating need for regeneration on reaching hand-set total in gallons. Design so signal will continue until reset.

2) Demand-Initiated Control: Equip single mineral-tank units with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons. Design so head automatically resets to preset total in gallons for next service run.

3) Demand-Initiated Control: Equip each mineral tank of twin mineral-tank units with automatic-reset-head water meters that electrically activate cycle controllers to initiate regeneration at preset total in gallons. Design so heads automatically reset to preset total in gallons for next service run. Include electrical lockout to prevent simultaneous regeneration of both tanks.

4) Demand-Initiated Control: Equip each mineral tank of twin mineral-tank units with automatic-reset-head water meter in common outlet header that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons and divert flow to other tank. Set to repeat with other tank. Include electrical lockout to prevent simultaneous regeneration of both tanks.

5) Demand-Initiated Control: Equip each mineral tank of multiple mineral-tank units with automatic-reset-head water meters that electrically activate cycle controllers to automatically regenerate at preset total in gallons. Design so heads automatically reset to preset total in gallons for next service run. Include electrical lockouts to prevent simultaneous regeneration of more than one tank.

6) Demand-Initiated Control: Equip each mineral tank of multiple mineral-tank units with automatic-reset-head water meter in common outlet header that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons and divert flow to other tanks. Set to repeat with other tanks. Include electrical lockouts to prevent simultaneous regeneration of more than one tank.
9. **Brine Tank**: Combination measuring and wet-salt storing system.
   a. **Tank and Cover Material**: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
   b. **Brine Valve**: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
   c. **Size**: Large enough for at least four regenerations at full salting.

10. **Factory-Installed Accessories**:
   a. Piping, valves, tubing, and drains.
   b. Sampling cocks.
   c. Main-operating-valve position indicators.
   d. Water meters.

B. **Capacity and Characteristics (Based on Peerless Model 450TCFM)**:

1. Control Valve: 2900.
2. Softener Tank Sizes: 30 inches x 72 inches.
3. Maximum Working Pressure: 100-psi
5. Service Pipe Size: 2 inches NPS.
7. Continuous Service Flow Rate: 73 gpm at 10-psig pressure drop.

C. **Capacity and Characteristics**:

1. **Service**: [Cold] [Hot] water.
2. **Water Analysis**:
   a. Hardness: <Insert grains/gal. or ppm.>
   d. Concentration: <Insert pH.>
   e. Inlet Water Pressure: <Insert psig.>
   f. Water Temperature: <Insert deg F.>
3. Continuous Service Flow Rate: <Insert number> gpm at 15-psig pressure drop.
4. Peak Service Flow Rate: <Insert number> gpm at 25-psig pressure drop.
5. Water Meter Size: <Insert NPS.>
6. Manifold Pipe Size: <Insert NPS.>
7. Backwash to Drain Pipe Size: <Insert NPS.>
8. Water Consumption: <Insert gal./day.>
9. Water Demand: <Insert hours/day.>
10. Number of Mineral Tanks: [One] [Two] [Three] <Insert number>.
13. **Electrical Characteristics**:
   a. Volts: <Insert value.>
   b. Phases: <Insert value.>
   c. Hertz: <Insert value.>
   d. Full-Load Amperes: <Insert value.>
e. Minimum Circuit Ampacity: <Insert value.>
f. Maximum Overcurrent Protection: <Insert value.>

15. Minimum Number of Regenerations per Refill: <Insert number.>
16. Floor Area Required: <Insert sq. ft.>
17. Height Required: <Insert inches.>

2.4 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: [30,000 grains/cu. ft.] <Insert capacity> of calcium carbonate of resin when regenerated with 15 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.

1. Form: Processed, [food-grade salt pellets] [plain salt pellets] [crystallized solar salt from shallow ponds and milled into irregular particles] [plain, brine block salt].

2.5 WATER TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

2.6 SOURCE QUALITY CONTROL

A. Hydrostatically test mineral tanks before shipment to minimum of one and one-half times pressure rating.

B. Prepare test reports.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated for commercial water softeners. Refer to Division 22 Section "Common Work Results for Plumbing."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of 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 elevation required for proper attachment to supported equipment.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 WATER SOFTENER INSTALLATION

A. Install household water softeners on floor.[ Anchor water softener and brine tanks to substrate.]

B. Install commercial water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

C. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure.

D. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

E. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

F. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric connections. Dielectric connections are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank.

E. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank[ and on inlet and outlet headers].

   1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
   2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
   3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

F. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."
1. Exception: Water softeners with factory-installed pressure gages at locations indicated.
2. Exception: Household water softeners.
3. Exception: Water softeners in hot-water service.

G. Install valved bypass water piping around water softeners.
   1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
   2. Plastic valves are specified in Division 22 Section "Domestic Water Piping."
   3. Water piping is specified in Division 22 Section "Domestic Water Piping."
   4. Exception: Household water softeners.
   5. Exception: Water softeners in hot-water service.

H. Install drains as indirect wastes to spill into open drains or over floor drains.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
   1. Water Analysis: Obtain water sample and perform water analysis.
   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.

D. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
B. Add water to brine tanks and fill with salt.
   1. Household Water Softeners: Processed [food-grade salt pellets] [plain salt pellets] [crystallized solar salt] <Insert salt form>.
   2. Commercial Water Softeners: [Plain salt pellets] [Crystallized solar salt] [Plain, brine block salt] [Food-grade salt pellets] <Insert salt form>.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics.

D. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:
   2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
   4. ASTM D 1126, "Test Method for Hardness in Water."
   5. ASTM D 1129, "Terminology Relating to Water."

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners. Refer to Division 01 "Demonstration and Training" Section

END OF SECTION 22 3100
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SECTION 22 3300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following electric water heaters:

1. Household, small-capacity electric water heaters.
2. Household, storage electric water heaters.
3. Household, collector-to-tank, solar-electric water heaters.
5. Flow-control, instantaneous electric water heaters.
6. Thermostat-control, instantaneous electric water heaters.
7. Light-commercial electric water heaters.
8. Commercial electric booster heaters.
9. Commercial, storage electric water heaters.
10. Compression tanks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittal:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7 - "Service Water Heating."

C. Shop Drawings: Diagram power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.

B. Field quality-control test reports.

C. Warranty: Special warranty specified in this Section.
1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. NSF Compliance as required by authorities having jurisdiction:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
   3. Comply with NSF 372, "Drinking Water System Components – Lead Content”

1.6 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:
   a. Household Electric Water Heaters:
      1) Storage Tank: [Five] [Six] [10] <Insert number> years.
      2) Controls and Other Components: [Two] [Three] <Insert number> years.
b. Instantaneous Electric Water Heaters: [One] [Two] [Five] <Insert number> year(s).

c. Light-Commercial Electric Water Heaters:

1) Storage Tank: [Three] [Five] <Insert number> years.

2) Controls and Other Components: [Two] [Three] <Insert number> years.

d. Commercial Electric Water Heaters:

1) Storage Tank: [Three] [Five] <Insert number> years.

2) Controls and Other Components: [Three] [Five] <Insert number> years.

e. Compression Tanks: [One] <Insert number> year(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 HOUSEHOLD ELECTRIC WATER HEATERS


B. Household, [Standard] [Tabletop], Storage Electric Water Heaters: Comply with UL 174.

1. Manufacturers:


c. Lochinvar Corporation.


f. Smith, A. O. Water Products Company.

g. State Industries, Inc.

2. Storage-Tank Construction: Steel.


b. Pressure Rating: 150 psig.

c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:
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2. ELECTRIC DOMESTIC WATER HEATERS

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
e. Jacket: Steel with enameled finish.

1) Standard: Cylindrical shape.
2) Tabletop: Rectangular shape, with flat-top work surface and raised back.

f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Heating Elements: Two; electric, screw-in immersion type with 12 kW or less total, and wired for nonsimultaneous operation, unless otherwise indicated.
h. Temperature Control: Adjustable thermostat for each element.
i. Safety Control: High-temperature-limit cutoff device or system.
j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

C. Household, Collector-to-Tank, Solar-Electric Water Heaters:

D. Household, Collector-to-Tank, Heat-Exchanger-Coil, Solar-Electric Water Heaters:

2.3 INSTANTANEOUS ELECTRIC WATER HEATERS

A. Flow-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.

1. Manufacturers:
   a. Chronomite Laboratories, Inc.
   b. Controlled Energy Corporation.
   c. Eemax, Inc.
   d. Hot Aqua, Inc.
   e. IMI Waterheating, Ltd.
   f. Stiebel Eltron, Inc.

2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.

   b. Pressure Rating: 150 psig.
   c. Heating Element: Resistance heating system.
   d. Temperature Control: Flow-control fitting.
   e. Safety Control: High-temperature-limit cutoff device or system.
   f. Jacket: Aluminum or steel with enameled finish or plastic.

B. Thermostat-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.

1. Manufacturers:
   a. Chronomite Laboratories, Inc.
   b. Controlled Energy Corporation.
   c. Eemax, Inc.
   d. Hot Aqua, Inc.
   e. IMI Waterheating, Ltd.
   f. Stiebel Eltron, Inc.

2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
   b. Pressure Rating: 150 psig.
   c. Heating Element: Resistance heating system.
   d. Temperature Control: Thermostat.
   e. Safety Control: High-temperature-limit cutoff device or system.
   f. Jacket: Aluminum or steel with enameled finish or plastic.


2.4 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS

A. Description: Comply with UL 174 for household, storage electric water heaters.

1. Manufacturers:
   c. Bock Water Heaters, Inc.
   d. Lochinvar Corporation.
   g. Smith, A. O. Water Products Company.
   h. State Industries, Inc.

2. Storage-Tank Construction: Steel, vertical arrangement.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1[ or ASHRAE 90.2].

e. Jacket: Steel with enameled finish.

f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.

h. Temperature Control: Adjustable thermostat for each element.

i. Safety Control: High-temperature-limit cutoff device or system.

j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.5 COMMERCIAL ELECTRIC WATER HEATERS

A. Commercial Electric Booster Heaters: Comply with UL 1453 requirements for booster-type water heaters.

B. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.

1. Manufacturers:

   b. Bock Water Heaters, Inc.
   d. Cemline Corporation.
   e. Lochinvar Corporation.
   f. PVI Industries, LLC.
   g. RECO USA.
   j. Smith, A. O. Water Products Company.
   k. State Industries, Inc.

2. Storage-Tank Construction: [ASME] [Non-ASME]-code, steel [horizontal] [vertical] arrangement.

   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Pressure Rating: 150 psig.

   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.

   1) Staging: Input not exceeding [18 kW] <Insert kW> per step.

   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.

2.6 COMPRESSION TANKS

A. 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.

1. Manufacturers:
   a. AMTROL Inc.
   b. Armstrong Pumps, Inc.
   c. Bell and Gossett.
   d. Smith, A. O.; Aqua-Air Div.
   e. State Industries, Inc.
   f. Taco, Inc.
   g. Watts Regulator Co.
   h. Wessels Co.

2. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.
2.7 WATER HEATER ACCESSORIES

A. Vacuum Relief Valves: ANSI Z21.22 rated and CSA certified with all brass body and protective cap.

B. Drain-Pan: Poly plastic drain pan with raised edge and drain outlet.

C. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

E. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch-high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

F. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.

G. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

H. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

I. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004 [or ASHRAE 90.2-2004].

2.8 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test[ commercial] water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.
1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer’s recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install 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.

D. Install[ combination temperature and] pressure relief valves in water piping for 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.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Install pressure gage(s) on[ inlet and] outlet of commercial electric water-heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

H. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.

I. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

J. Fill water heaters with water.

K. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect[, test, and adjust] field-assembled components and equipment installation, including connections[, and to assist in field testing]. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain [commercial] [and] [instantaneous] electric water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3300
WMU Design Guidelines

WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 3400 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fuel-fired water heaters:

1. Household, atmospheric, storage, gas water heaters.
2. Household, direct-vent, storage, gas water heaters.
3. Household, power-vent, storage, gas water heaters.
4. Instantaneous, tankless, gas water heaters.
5. Commercial, atmospheric, storage, gas water heaters.
6. Commercial, power-burner, storage, gas water heaters.
7. Commercial, power-vent, storage, gas water heaters.
8. Commercial, high-efficiency, gas water heaters.
12. Commercial, oil-fired water heaters.
13. Large-capacity, oil-fired water heaters.
15. Expansion tanks.

1.2 DEFINITIONS

A. LP Gas: Liquefied-petroleum fuel gas.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, 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: Diagram power, signal, and control wiring.
1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.
B. Field quality-control test reports.
C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements.”
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
D. ASME Compliance:
   1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
   2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
E. NSF Compliance as required by authorities having jurisdiction:
   2. Comply with NSF 61, “Drinking Water System Components - Health Effects; Sections 1 through 9.”

1.7 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.
1.8  WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:
   a. Household, Gas Water Heaters:
      1) Storage Tank: \[\text{Five} \fs{3} \text{Six} \fs{3} \text{Ten} <\text{Insert number}> \text{ years.}
      2) Controls and Other Components: \[\text{Two} \fs{3} \text{Three} <\text{Insert number}> \text{ years.}
   b. Instantaneous, Gas Water Heaters:
      1) Heat Exchanger: \[\text{Five} <\text{Insert number}> \text{ years.}
      2) Controls and Other Components: \[\text{Three} <\text{Insert number}> \text{ years.}
   c. Commercial, Gas Water Heaters:
      1) Storage Tank: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
      2) Controls and Other Components: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
   d. Oil-Fired Water Heaters:
      1) Storage Tank: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
      2) Burner and Controls: \[\text{One} \fs{3} \text{Two} \fs{3} \text{Three} <\text{Insert number}> \text{ year(s).}
      3) Other Components: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
   e. Dual-Fuel Water Heaters:
      1) Storage Tank: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
      2) Burner and Controls: \[\text{One} \fs{3} \text{Two} \fs{3} \text{Three} <\text{Insert number}> \text{ year(s).}
      3) Other Components: \[\text{Three} \fs{3} \text{Five} <\text{Insert number}> \text{ years.}
   f. Expansion Tanks: \[\text{One} <\text{Insert number}> \text{ year(s).}

1.9  PROJECT COMMISSIONING

A. Project is attempting to obtain Leed Certification and has an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 HOUSEHOLD, GAS WATER HEATERS


1. Manufacturers:
2. [Available ]Manufacturers:

b. Apollo Heating & Cooling; a division of State Industries, Inc.
d. GSW Water Heating Company.
e. Lochinvar Corporation.
i. Smith, A. O. Water Products Company.
j. State Industries, Inc.
k. <Insert manufacturer's name.>


b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
e. Jacket: Steel with enameled finish.
f. Burner: For use with atmospheric water heaters and for natural-gas fuel.
g. Burner: For use with atmospheric water heaters and for [natural-gas] [LP-gas]
   <Insert fuel gas> fuel.
i. Temperature Control: Adjustable thermostat.

j. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

k. Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.


7. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 \ deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 \ deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   g. Electrical Characteristics:
      1) Volts: [120] [240] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   h. Minimum Vent Diameter: <Insert inches>.


1. Manufacturers:

2. \textbf{Available } Manufacturers:
   b. Apollo Heating & Cooling; a division of State Industries, Inc.
   d. Lochinvar Corporation.
   g. Smith, A. O. Water Products Company.
   h. State Industries, Inc.
   i. <Insert manufacturer's name>.

   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
e. Jacket: Steel with enameled finish.
f. Burner: For use with direct-vent water heaters and for natural-gas fuel.
g. Burner: For use with direct-vent water heaters and for [natural-gas] [LP-gas] fuel.
i. Temperature Control: Adjustable thermostat.
j. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
k. Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

5. Direct-Vent System: Through-[wall] [roof], coaxial- or double-channel, vent assembly with water heater manufacturers’ outside intake/exhaust screen.

6. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Inserr deg F> temperature rise.
   c. Temperature Setting: [125 deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.  
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   g. Electrical Characteristics:
      1) Volts: [120] [240] <Insert value>.  
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   h. Minimum Vent Diameter: <Insert inches>.


1. Manufacturers:
2. [Available] Manufacturers:
   b. Apollo Heating & Cooling; a division of State Industries, Inc.
   d. GSW Water Heating Company.
   e. Lochinvar Corporation.
   h. Smith, A. O. Water Products Company.
   i. State Industries, Inc.
   j. <Insert manufacturer's name>.

   b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Burner: For use with power-vent water heaters and for natural-gas fuel.
   g. Burner: For use with power-vent water heaters and for [natural-gas] [LP-gas] fuel.
   i. Temperature Control: Adjustable thermostat.
   j. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   k. Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.


6. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   g. Electrical Characteristics:
      1) Volts: [120] [240] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Amperage: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   h. Minimum Vent Diameter: <Insert inches>.

2.3 INSTANTANEOUS, GAS WATER HEATERS

A. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.

1. Manufacturers:
2. [Available] Manufacturers:
   a. Controlled Energy Corporation.
   b. NORITZ America Corporation.
   c. Paloma Industries, Inc.
   d. Takagi Industrial Co. USA, Inc.
   e. <Insert manufacturer's name>
3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
   b. Pressure Rating: 150 psig.
   c. Heat Exchanger: Copper tubing.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Burner: For use with tankless water heaters and for [natural-gas] [LP-gas] fuel.
   f. Burner: For use with tankless water heaters and for fuel.
   g. Automatic Ignition: Manufacturer’s proprietary system for automatic, gas ignition.
   h. Temperature Control: Adjustable thermostat.
   i. Jacket: Metal with enameled finish or plastic.


5. Capacity and Characteristics:
   a. Flow Rate: <Insert gpm> at [100 deg F] <Insert deg F> temperature rise.
   b. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   c. Fuel Gas Demand: <Insert cfh>.
   d. Fuel Gas Input: <Insert Btu/h>.
   e. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   f. Electrical Characteristics:
      1) Volts: [120] <Insert value>.
      2) Phase: Single.
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   g. Minimum Vent Diameter: <Insert inches>.

2.4 COMMERCIAL, GAS WATER HEATERS


1. Manufacturers:
2. [Available] Manufacturers:
   b. Bock Water Heaters, Inc.
   d. GSW Water Heating Company.
   e. HESco Industries, Inc.
   f. Lochinvar Corporation.
   g. PVI Industries, LLC.
   j. Smith, A. O. Water Products Company.
   k. State Industries, Inc.
   l. <Insert manufacturer’s name>.

WMU Design Guidelines

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FUEL FIRED DOMESTIC WATER HEATERS

rev. July 2019

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
   1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] <Insert material> 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: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Burner: For use with atmospheric water heaters and for natural-gas fuel.
   g. Burner: For use with atmospheric water heaters and for [natural-gas] [LP-gas] <Insert fuel gas> fuel.
   i. Temperature Control: Adjustable thermostat.
   j. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
   k. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.
7. Automatic Damper: ANSI Z21.66, [electrically operated] [mechanically activated] [thermally activated], automatic-vent-damper device with size matching draft hood.
9. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   g. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
5) Minimum Circuit Ampacity: <Insert value.>
6) Maximum Overcurrent Protection: <Insert value.>

h. Minimum Vent Diameter: <Insert inches.>


1. Manufacturers:
2. [Available] Manufacturers:
   a. Aldrich Company.
   b. Bock Water Heaters, Inc.
   d. HESco Industries, Inc.
   e. Precision Boilers.
   f. PVI Industries, LLC.
   g. RECO USA.
   h. Sellers Engineering Co.
   i. Smith, A. O. Water Products Company.
   j. <Insert manufacturer’s name.>

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] <Insert material> 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: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas fuel.
a. Manufacturers:
b. [Available] Manufacturers:

1) Adams Manufacturing Co.
2) Aero Environmental Ltd.
3) Carlin Combustion Technology, Inc.
4) Gordon-Platt Group; John Zink Company, LLC.
5) Midco International Inc.
6) Power Flame, Inc.
7) Webster Engineering Co., L.L.C.
8) <Insert manufacturer’s name.>

C. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.

8. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
10. Draft Hood: [Draft diverter; complying with ANSI Z21.12] <Insert different hood or other arrangement>.
12. Capacity and Characteristics:
b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
d. Fuel Gas Demand: <Insert cfh>.
e. Fuel Gas Input: <Insert Btu/h>.
f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
g. Electrical Characteristics:
   1) Volts: [120] [240] [277] [480] <Insert value>.
   2) Phase: [Single] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert value>.
h. Minimum Vent Diameter: <Insert inches>.


1. Manufacturers:
2. [Available] Manufacturers:

b. Lochinvar Corporation.
e. Smith, A. O. Water Products Company.
f. <Insert manufacturer’s name.>

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1. FUEL FIRED DOMESTIC WATER HEATERS

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
   1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] <Insert material> 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: Provide unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.

e. Jacket: Steel with enameled finish.

f. Burner: For use with power-vent water heaters and for natural-gas fuel.

g. Burner: For use with power-vent water heaters and for [natural-gas] [LP-gas] <Insert fuel gas> fuel.


i. Temperature Control: Adjustable thermostat.

j. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

k. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valve with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.


8. Capacity and Characteristics:


b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.

c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.

d. Fuel Gas Demand: <Insert cfh>.

e. Fuel Gas Input: <Insert Btu/h>.

f. Gas Pressure Required at Burner: <Insert psig or inches> water column.

g. Electrical Characteristics:
   1) Volts: [120] [240] [277] [480] <Insert value>.
   2) Phase: [Single] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert value>.

h. Minimum Vent Diameter: <Insert inches>.

1. **Manufacturers:**
2. **Available Manufacturers:**
   a. AERCO International.
   c. Heat Transfer Products, Inc.
   d. Laars Heating Systems; Waterpik Technologies, Inc.
   e. Lochinvar Corporation.
   f. Patterson-Kelley.
   h. Smith, A. O. Water Products Company.
   i. State Industries, Inc.
   j. Weben-Jarco, Inc.
   k. <Insert manufacturer's name.>
   l. RBI Water Heaters; a Mestek, Inc. Company.

3. **Description:** Manufacturer's proprietary design to provide at least \(84\) \(85\) \(88\) \(95\) \(<\text{Insert number}>\) percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.

4. **Storage-Tank Construction:** ASME-code steel with \(150\)-psig \(<\text{Insert psig}>\) minimum working-pressure rating.
   a. **Tappings:** Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. **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:** \([\text{Cement}]\) \([\text{Glass}]\) \([\text{Nickel plate}]\) \([\text{Phenolic coating}]\) \([\text{Sheet copper}]\) \(<\text{Insert material}>\) complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. **Factory-Installed, Storage-Tank Appurtenances:**
   a. **Anode Rod:** Replaceable magnesium.
   b. **Dip Tube:** Provide unless cold-water inlet is near bottom of tank.
   c. **Drain Valve:** Corrosion-resistant metal complying with ASSE 1005.
   d. **Insulation:** Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. **Jacket:** Steel with enameled finish.
   f. **Combination Temperature and Pressure Relief Valves:** ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
6. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for natural-gas fuel.

7. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for [natural-gas] [LP-gas] <Insert fuel gas> fuel.

8. Temperature Control: Adjustable thermostat.

9. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.


11. Draft Hood: [Draft diverter; complying with ANSI Z21.12] <Insert different hood or other arrangement>.

12. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Gas Pressure Required at Burner: <Insert psig or inches> water column.
   g. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   h. Minimum Vent Diameter: <Insert inches>.

E. Commercial, Coil-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.

1. Manufacturers:
2. [Available] Manufacturers:
   a. Ajax Boiler Inc.
   b. HESco Industries, Inc.
   c. Smith, A. O. Water Products Company.
   d. Weben-Jarco, Inc.
   e. <Insert manufacturer’s name>.

3. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
   a. Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
   b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.

   1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
5. Boiler Appurtenances:
   a. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
   b. Jacket: Steel with enameled finish.
   c. Burner: For use with coil-type, finned-tube water heaters and for natural-gas fuel.
   e. Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.
   f. Safety Control: Automatic, high-temperature-limit cutoff device or system.


7. Support: Steel base or skids.

8. Draft Hood: [Draft diverter; complying with ANSI Z21.12] <Insert different hood or other arrangement>.


   b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   g. Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
   h. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, [125-psig] <Insert psig> minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.

12. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.


14. Capacity and Characteristics:
a. Hot-Water Storage-Tank Capacity: \(<\text{Insert gal.}>\)
b. Recovery: \(<\text{Insert gph}>\) at \([\text{100 deg F}] <\text{Insert deg F}>\) temperature rise.
c. Temperature Setting: \([\text{125 deg F}] [\text{140 deg F}] <\text{Insert temperature}>\).
d. Fuel Gas Demand: \(<\text{Insert cfh.}>\)
e. Fuel Gas Input: \(<\text{Insert Btu/h.}>\)
f. Gas Pressure Required at Burner: \(<\text{Insert psig or inches}>\) water column.
g. Electrical Characteristics:
   1) Volts: \([\text{120}] [\text{240}] [\text{277}] [\text{480}] <\text{Insert value}>\).
   2) Phase: \([\text{Single}] [\text{Three}]\).
   3) Hertz: 60.
   4) Full-Load Amperes: \(<\text{Insert value}>\).
   5) Minimum Circuit Ampacity: \(<\text{Insert value}>\).
   6) Maximum Overcurrent Protection: \(<\text{Insert value}>\).
h. Minimum Vent Diameter: \(<\text{Insert inches.}>\)

F. Commercial, Grid-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.

1. Manufacturers:
2. \([\text{Available}]\) Manufacturers:
   b. Laars Heating Systems; Waterpik Technologies, Inc.
   c. Lochinvar Corporation.
   d. Precision Boilers.
   e. Raypak.
   f. RECO USA.
   i. Smith, A. O. Water Products Company.
   j. \(<\text{Insert manufacturer's name.}>\)
   k. RBI Water Heaters; a Mestek, Inc. Company.
3. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
4. Boiler Construction: ASME code with \([\text{160-psig}] <\text{Insert psig}>\) working-pressure rating for hot-water-boiler-type water heater.
   a. Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
   b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
5. Boiler Appurtenances:
   a. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
   b. Jacket: Steel with enameled finish.
   c. Burner: For use with grid-type, finned-tube water heaters and for natural-gas fuel.
d. Burner: For use with grid-type, finned-tube water heaters and for [natural-gas] [LP-gas] [Insert fuel gas] fuel.

e. Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.

f. Safety Control: Automatic, high-temperature-limit cutoff device or system.


7. Support: Steel base or skids.

8. Draft Hood: [Draft diverter; complying with ANSI Z21.12] [Insert different hood or other arrangement].


b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.

e. Jacket: Steel with enameled finish.


g. Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.

h. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, [125-psig] [Insert psig] minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.

12. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.


14. Capacity and Characteristics:

a. Hot-Water Storage-Tank Capacity: [Insert gal.]

b. Recovery: [Insert gph] at [100 deg F] [Insert deg F] temperature rise.

c. Temperature Setting: [125 deg F] [140 deg F] [Insert temperature].

d. Fuel Gas Demand: [Insert cfm].

e. Fuel Gas Input: [Insert Btu/h].

f. Gas Pressure Required at Burner: [Insert psig or inches] water column.
g. Electrical Characteristics:
   1) Volts: [120] [240] [277] [480] <Insert value>.
   2) Phase: [Single] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert value>.

h. Minimum Vent Diameter: <Insert inches>.

2.5 OIL-FIRED WATER HEATERS

A. Household, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.

1. Available Manufacturers:
   a. Aero Environmental Ltd.
   b. Bock Water Heaters, Inc.
   d. GSW Water Heating Company.
   e. Lochinvar Corporation.
   f. Therma-Flow/Everhot.
   g. <Insert manufacturer’s name>.

2. Storage-Tank Construction: Steel.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Temperature Control: Adjustable thermostat.
   g. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
5. Draft Regulator: Barometric type or adjustable-damper device.
6. Capacity and Characteristics:
   b. Recovery: <Insert gph> at 100 deg F <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel-Oil Demand: <Insert gpm>.
   e. Fuel-Oil Input: <Insert Btu/h>.
   f. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480] <Insert value>.
2) Phase: [Single] [Three].
3) Hertz: 60.
4) Full-Load Amperes: <Insert value.>
5) Minimum Circuit Ampacity: <Insert value.>
6) Maximum Overcurrent Protection: <Insert value.>
7) Minimum Vent Diameter: <Insert inches.>

B. Commercial, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.

1. [Available] Manufacturers:
   a. Aero Environmental Ltd.
   b. Aldrich Company.
   c. Bock Water Heaters, Inc.
   e. GSW Water Heating Company.
   f. Heat Transfer Products, Inc.
   g. HESco Industries, Inc.
   h. Lochinvar Corporation.
   i. Precision Boilers.
   j. Smith, A. O. Water Products Company.
   k. State Industries, Inc.
   l. Therma-Flow/Everhot.
   m. <Insert manufacturer's name.>

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] <Insert material> complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Temperature Control: Adjustable thermostat.
   g. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Oil Burners: Comply with UL 296 for use with No. 2 fuel oil.
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a. [Available] Manufacturers:
1) Adams Manufacturing Co.
2) Aero Environmental Ltd.
4) Carlin Combustion Technology, Inc.
5) Gordon-Piatt Group; John Zink Company, LLC.
6) Power Flame, Inc.
7) Webster Engineering Co., L.L.C.
8) <Insert manufacturer’s name.>

5. Safety Control: Automatic, high-temperature-limit cutoff device or system.
6. Draft Regulator: Barometric type or adjustable-damper device.
8. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel-Oil Demand: <Insert gpm>.
   e. Fuel-Oil Input: <Insert Btu/h>.
   f. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   g. Minimum Vent Diameter: <Insert inches>.

C. Large-Capacity, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters except when capacity is greater than 120 gal.

1. [Available] Manufacturers:
   a. Aldrich Company.
   b. Bock Water Heaters, Inc.
   c. HESco Industries, Inc.
   d. Precision Boilers.
   e. PVI Industries, LLC.
   f. RECO USA.
   g. Smith, A. O. Water Products Company.
   h. <Insert manufacturer’s name>.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper]  
<Insert material> complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Control: Automatic, high-temperature-limit cutoff device or system.
   h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
   a. Available Manufacturers:
      1) Adams Manufacturing Co.
      2) Aero Environmental Ltd.
      4) Carlin Combustion Technology, Inc.
      5) Gordon-Piatt Group; John Zink Company, LLC.
      6) Power Flame, Inc.
      7) Webster Engineering Co., L.L.C.
      8) <Insert manufacturer's name.>

5. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

6. Draft Regulator: Barometric type or adjustable-damper device.


8. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel-Oil Demand: <Insert gpm>.
   e. Fuel-Oil Input: <Insert Btu/h>.
   f. Electrical Characteristics:
      1) Volts: [120] [240] [277] [480] <Insert value>.
      2) Phase: [Single] [Three].
      3) Hertz: 60.
      4) Full-Load Amperes: <Insert value>.
      5) Minimum Circuit Ampacity: <Insert value>.
      6) Maximum Overcurrent Protection: <Insert value>.
   g. Minimum Vent Diameter: <Insert inches>.
2.6 DUAL-FUEL WATER HEATERS

A. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas and oil-fired water heaters.

1. [Available] Manufacturers:
   a. Aldrich Company.
   b. Bock Water Heaters, Inc.
   c. HESco Industries, Inc.
   d. Precision Boilers.
   e. PVI Industries, LLC.
   f. RECO USA.
   g. Smith, A. O. Water Products Company.
   h. <Insert manufacturer's name.>

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. 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: [Cement] [Glass] [Nickel plate] [Phenolic coating] [Sheet copper] <Insert material> complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Temperature Control: Adjustable thermostat.
   g. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Dual-Fuel Burners: Combination gas-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for [natural-gas] [LP-gas] <Insert fuel gas> fuel.
   a. [Available] Manufacturers:
      1) Gordon-Piatt Group; John Zink Company, LLC.
      2) Power Flame, Inc.
      3) Webster Engineering Co., L.L.C.
      4) <Insert manufacturer's name.>

5. Safety Control: Automatic, high-temperature-limit cutoff device or system.
8. Capacity and Characteristics:
   b. Recovery: <Insert gph> at [100 deg F] <Insert deg F> temperature rise.
   c. Temperature Setting: [125 deg F] [140 deg F] <Insert temperature>.
   d. Fuel Gas Demand: <Insert cfh>.
   e. Fuel Gas Input: <Insert Btu/h>.
   f. Fuel-Oil Demand: <Insert gpm>.
   g. Fuel-Oil Input: <Insert Btu/h>.
h. Electrical Characteristics:
   1) Volts: [120] [240] <Insert value>.
   2) Phase: [Single] [Three].
   3) Hertz: 60.
   4) Full-Load Amperes: <Insert value>.
   5) Minimum Circuit Ampacity: <Insert value>.
   6) Maximum Overcurrent Protection: <Insert value>.
i. Minimum Vent Diameter: <Insert inches>.

2.7 EXPANSION TANKS

A. Diaphragm-Type Expansion Tanks:

1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

   a. Manufacturers:

   1) AMTROL Inc.
   2) Armstrong Pumps, Inc.
   3) Bell and Gossett.
   4) Flexcon Industries.
   5) Honeywell Sparco.
   6) Myers, F. E.; Pentair Pump Group (The).
   7) Smith, A. O.; Aqua-Air Div.
   8) State Industries, Inc.
   9) Taco, Inc.
   10) Watts Regulator Co.
   11) Wessels Co.

   b. Construction:

   1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   3) Air-Charging Valve: Factory installed.
   4) Working-Pressure Rating: 150 psig(1035 kPa).
2. Capacity and Characteristics:
   b. Air Precharge Pressure: <Insert system pressure.>

2.8 WATER HEATER ACCESSORIES

A. Vacuum Relief Valves: ANSI Z21.22 rated and CSA certified with all brass body and protective cap.

B. Drain-Pan: Poly plastic drain pan with raised edge and drain outlet.


D. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

E. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

F. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
   2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.

G. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
   2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.

H. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

I. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches above the floor.

J. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

K. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

L. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
M. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.9 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test [commercial] water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install seismic restraints for commercial water heaters. Anchor to substrate.

D. Install gas water heaters according to NFPA 54.

E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.

G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.

H. Install oil-fired water heaters according to NFPA 31.

I. 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.
J. Install [combination temperature and] pressure relief valves in water piping for 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.

K. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

L. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

M. Install pressure gage(s) on [inlet and] outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

N. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

O. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

P. Fill water heaters with water.

Q. Charge diaphragm expansion tanks with air.

R. Install bladder expansion tanks on the floor. Vent and purge air from system, and ensure tank is properly charged with air to suit system Project requirements.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instantaneous and commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3400
WMU Design Guidelines Instructions: These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for all University projects. These guidelines have been edited to reflect WMU preferences, and the intent is for the Design Professional to use this information to guide their normal specifications-writing process. Straying from what is indicated in the guidelines is not prohibited, but shall be discussed with WMU during the development of the project.

SECTION 22 4000 - PLUMBING FIXTURES

DESIGNER NOTE: This section covers general plumbing fixtures for restrooms, breakrooms, water coolers, and emergency fixtures. Specialty fixtures for laboratory, healthcare, or food service shall be discussed with the University during the design phases of the project.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes plumbing fixtures and related components.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for stainless steel under lavatory protection shields.
2. Division 10 Section "Toilet, Bath, and Laundry Accessories" for plastic under lavatory protection shields.
3. Division 10 Section "Toilet, Bath, and Laundry Accessories" for plastic under lavatory trap and supplies insulation kit.
4. Division 22 Section "Domestic Water Piping Specialties" for mixing valves and specialty fixtures not included in this Section.
5. Division 22 Section "Domestic Water Filtration Equipment" for water filters.
6. Division 22 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.2 DEFINITIONS

A. Barrier-Free Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Piping and general-duty valves are included where indicated. Fittings specified in this Section include:

1. Supplies and stops.
2. Faucets and spouts.
3. Drains and tailpieces.
4. Traps and waste pipes.
5. Shower heads.
1.3 ACTION SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. LEED Submittal:
   1. Product Data for Credit WE [3.1] [3.2] [3.1, and 3.2]: Documentation indicating flow and water consumption requirements.
   2. Product Data for Credit WE [2] [3.1] [3.2] [2 and 3.1] [2, 3.1, and 3.2]: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Diagram power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
   1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with the following:
   3. Local authority having jurisdiction.
   4. Michigan and local Department of Health requirements.


F. NSF Compliance as required by authorities having jurisdiction:
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specified requirements, provide commercial grade plumbing fixtures by one of the following:

1. Lavatories, Water Closets, Urinals, Service Sinks, Bath Tubs:
2. Lavatories, Water Closets, Urinals:
   a. American Standard
   b. Kohler
   c. Zurn
   d. Toto

3. Waterless Urinals:
   a. Falcon Waterfree Technologies.
   b. Sloan Co.
   c. American Standard.
   d. Waterless.
   e. Zeroflush.
   f. Zurn.

4. Stainless Steel Sinks:
   a. Elkay
   b. Just
   c. Franke Commercial

5. Mop Basins:
   a. Fiat
   b. Florestone
   c. Mustee
   d. Zurn

6. Faucets:
   a. Zurn

7. Faucets and Showers:
a. American Standard
b. Chicago Faucet
c. Delta
d. Kohler
e. T & S Brass
f. Speakman
g. Symmons
h. Zurn

8. Flush Valves:
a. Zurn

9. Flush Valves:
   a. Sloan
   b. Zurn
c. Delta
d. Delany

10. Water Closet Seats:
    a. American Standard
    b. Bemis
c. Centoco
d. Kohler

11. Water Coolers:
    a. Elkay

12. Drinking Fountains:
    a. Elkay
    b. Oasis
c. Halsey-Taylor
d. Haws

13. Remote Coolers for Drinking Fountains:
    a. Elkay
    b. Oasis
c. Halsey-Taylor
d. Haws

14. Shower Head and Valves:
    a. Acorn Controls.
    b. Bradley
c. Chicago Faucet
d. Powers
e. Speakman
f. Symmons
g. Delta
h. Leonard
i. Zurn
j. Kohler
k. American Standard

15. Tub/Shower Systems:
   a. Aqua Glass
   b. Aqua Bath
   c. Clarion
   d. Comfort Designs
   e. Florestone
   f. Lasco
   g. Kohler

16. Prefabricated Modular Shower Systems:
   a. Acorn
   b. Bradley
   c. Powers

17. Shower Panels:
   a. Bradley
   b. Speakman
   c. Symmons
   d. Leonard
   e. Zurn
   f. Powers
   g. Acorn

18. Emergency Shower and Eye Washes:
   a. Bradley
   b. Haws
   c. Guardian

19. Fixture Supports:
   a. Wade
   b. Zurn
   c. Jay R. Smith
   d. Watts.

20. Security Fixtures:
   a. Acorn
   b. Bradley
   c. Willoughby
   d. Metcraft

2.2 BARRIER-FREE FIXTURES

A. All fixtures are to be furnished and installed as barrier-free even though the room or area is not
totally designed as barrier-free. The exceptions are the mop basins, shampoo sinks, and
standard height electric water coolers.
2.3 WATER CLOSETS

A. WC-1 Water Closets (Wall Mounted): Vitreous china, back outlet, wall hung, 1.28 gallon siphon jet elongated closet bowl, white in color, with 1-1/2" top spud. American Standard "Afwall Millennium" Model 3351.101 or equivalent. Provide carriers, seat, and flush valve as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free requirements.)

B. WC-1 Water Closets (Wall Mounted): Vitreous china, back outlet, wall hung, 1.28 gallon siphon jet elongated closet bowl, white in color, with 1-1/2" top spud. American Standard "Afwall" Model 3351.001 or equivalent. Provide carriers, TS-1 seat, and FV-1 flush valve as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free requirements.)

C. WC-1 Water Closets (Floor Mounted): Vitreous china, bottom outlet, floor mounted, 1.28 gallon siphon jet elongated bowl, white in color, with 1 1/2" top spud. American Standard "Madera" Model 2234.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

D. WC-1 Water Closets (Barrier-Free Floor Mounted): Vitreous china, bottom outlet, floor mounted, 1.28 gallon siphon jet elongated bowl, white in color, with 1-1/2" top spud; American Standard "Madera" Model 3043.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

E. WC-1 Water Closets (Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with 1 1/2" top spud. American Standard "Madera" Model 3451.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

F. WC-1 Water Closets (Barrier-Free Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with 1-1/2" top spud; American Standard "Madera" Model 3461.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

G. WC-1 Water Closets (Barrier-Free Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with close-coupled [tank]; American Standard "Madera Youth" Model 2595.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

H. WC-1 Water Closets (Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with close-coupled [tank]; American Standard "Cadet" Model 215CB.104 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below.

I. WC-1 Water Closets (Barrier-Free Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with close-coupled [tank]; American Standard "Cadet" Model 215AB.104 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below.
J. WC-1L Water Closets (Barrier-Free Floor Mounted): Vitreous china, [tank type, pressure-assisted], bottom outlet, floor mounted 1.0 gallon elongated bowl water closet, white in color; Kohler "Highline" Model K-3519 [(left hand trip lever)]. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below.

K. WC-1R Water Closets (Barrier-Free Floor Mounted): Vitreous china, [tank type, pressure-assisted], bottom outlet, floor mounted 1.0 gallon elongated bowl water closet, white in color; Kohler "Highline" Model K-3519-RA [(right hand trip lever)]. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below.

L. WC-1 Water Closets (Floor Mounted): Vitreous china, bottom outlet, floor mounted [1.28] gallon siphon jet, round front bowl, white in color, with 1 1/2" top spud. American Standard "Baby Devoro" Model 2282.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

M. WC-1 Water Closets ([Child Barrier-Free Floor Mounted]): Vitreous china, bottom outlet, floor mounted [1.28] gallon siphon jet elongated bowl with 14" high rim, white in color, with 1 1/2" top spud. American Standard "Madera" Model 22821.001 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

N. SWC-1 Water Closets (Wall Mounted): Vitreous china, back outlet, floor mounted, 1.6 gallon siphon jet elongated closet bowl, white in color, with 1-1/2" back spud and integral seat. American Standard "Neolo" Model 2531.116 or equivalent. Provide FV-3 flush valve as specified in the Articles below.

O. WC-1 Water Closets (Barrier-Free Floor Mounted Bariatric): Vitreous china, bottom outlet, floor mounted [1.28] gallon siphon jet elongated bowl load tested to 2,000 pounds, white in color, with 1-1/2" top spud; American Standard Model 3641.001 or equivalent from manufacturers list. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide FV-1 flush valve as specified in the Articles below.

1. Oversized toilet seat furnished with unit.

P. WC-2 Water Closets (Barrier-Free Floor Mounted Back Outlet): Vitreous china, back outlet, floor mounted, 1.6 gallon siphon jet elongated closet bowl, white in color, with 1-1/2" back spud and integral seat. American Standard "Huron" Model 3341.001 or equivalent. Provide FV-1 flush valve as specified in the Articles below.

Q. WC-1 Water Closets (Barrier-Free Floor Mounted Back Outlet): Vitreous china, back outlet, floor mounted, 1.6 gallon siphon jet elongated closet bowl, white in color, with 1-1/2" back spud and seat holes. American Standard "Huron" Model 3342.001 or equivalent. Provide TS-1 seat and FV-1 flush valve as specified in the Articles below.

2.4 URINALS

A. UR-1 Urinals (Wall Mounted): Vitreous china, washout [0.125][0.5] gallon wall urinal, white in color, with integral extended shields, flushing rim and trap, 3/4" top spud, 2" outlet connection and supporting hangers. American Standard "Washbrook" Model 6590.001 or equivalent.
Provide carriers and flush valve as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free rim heights.)

2.5 WATERLESS URINALS

A. UR-1 Urinals (Wall Mounted): Vitreous china, water-free urinal designed for liquid-trap-seal operation, white in color, proprietary cartridge trap sealing system, 2" outlet connection and supporting hanger. Sloan Model WES-1000 or equivalent. Provide carriers as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free rim heights.)

2.6 LAVATORIES

A. LAV-1 Lavatories: 20" x 18" vitreous china lavatory, white in color, with backsplash, front overflow, and chrome plated non-removable grid strainer with tailpiece, fabricated for concealed arm or wall hanger supports. Drill lavatories for 4" center faucets. American Standard "Lucerne" Model 0355.012 or equivalent. Provide concealed arm carriers, faucet, trap, and supplies and stops as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free requirements.)

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory within trap shield. Refer to Section 22 1119 for mixing valve.
3. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.
4. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.
5. Provide plastic under lavatory trap and supplies shield on barrier-free units. Refer to articles below.

B. LAV-1 Lavatories: 20" x 18" vitreous china lavatory, white in color, with backsplash, front overflow, and chrome plated non-removable grid strainer with tailpiece, fabricated for concealed arm or wall hanger supports. Drill lavatories for 4"[8"][single hole] center faucets. American Standard "Lucerne" Model 0355.012[0356.015][0356.421] or equivalent. Provide concealed arm carriers, F-1 faucet, trap, and supplies and stops as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free requirements.)

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory within trap shield. Refer to Section 22 1119 for mixing valve.
3. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.
4. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.
5. Provide plastic under lavatory trap and supplies shield on barrier-free units. Refer to articles below.

C. LAV-2 Countertop Lavatories: Vitreous china self-rimming countertop lavatory, white in color, with front overflow, faucet ledge, and chrome plated non-removable grid strainer with tailpiece. Drilled for 4" center faucet. American Standard "Aqualyn" Model 0476.028 or equivalent. Provide faucet, trap, supplies and stops as specified in the Articles below.
1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory behind kneeboard. Refer to Section 22 1119 for mixing valve.
3. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.
4. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.

D. LAV-3 Countertop Lavatories: Vitreous china square undermount countertop lavatory, white in color, with chrome plated non-removable grid strainer with offset tailpiece. American Standard "Studio" Model 0614.000. Provide faucet, trap, supplies and stops as specified in the Articles below.


F. LAV-3 Countertop Lavatories: Vitreous china square undermount countertop lavatory, white in color, with chrome plated non-removable grid strainer with tailpiece. American Standard "Studio Carre" Model 0426.000 or equivalent. Provide F-1 faucet, trap, supplies and stops as specified in the Articles below.

G. LAV-3 Countertop Lavatories: Vitreous china undermount countertop lavatory, white in color, with front overflow, and chrome plated non-removable grid strainer with tailpiece. Drilled for 4" center faucet. American Standard "Ovalyn" Model 0495.221 or equivalent. Provide F-1 faucet, trap, supplies and stops as specified in the Articles below.

H. LAV-3 Countertop Lavatories: Lavatory bowls integral with solid surface countertop. Provide F-1 faucet, trap, supplies and stops as specified in the Articles below.

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory within trap cover. Refer to Section 22 1119 for mixing valve.
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2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory behind kneeboard. Refer to Section 22 1119 for mixing valve.

3. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.

4. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.

I. LAV-3 Countertop Lavatories (Barrier-Free): Stainless steel undermount countertop lavatory, [mirror][luster] finish, without overflow. Kohler "Bachata" Model K-2608. Provide F-1 faucet, trap, supplies and stops as specified in the Articles below.

1. Provide chrome plated non-removable grid strainer with offset tailpiece.

2. Provide thermostatic mixing valve on hot water line to barrier-free lavatory faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.

3. Provide p-trap type trap primer where indicated. Refer to Section 22 1319 for p-trap type trap primer.

4. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to Section 10 2800 for kit.

J. SLAV-3 Prison Lavatories: 14" x 12-3/4" vitreous china lavatory, white in color, with integral spout and drinking nozzle, soap depression, hot and cold push button supply fixture, integral slow drain bowl outlet, and split-joint drain connection, suitable for installation on [4" and smaller ] [4" and larger ] block wall [with accessible chase]. American Standard Model [0421.018 ] or equivalent. Provide trap, and stops as specified in the Articles below.

2.7 MOP BASINS

A. MB-1 Mop Basin: One piece molded stone 10" high basin with 2" shoulders 24" x 24" overall basin size. Furnish with factory installed 3" drain body with removable stainless steel strainer. Furnish with [manufacture's standard mop hanger, two stainless steel wall shields, and hose and horse bracket accessories for field installation. Mustee Model 63M or equivalent.

B. MB-1 Mop Basin: One piece [square][ neo-corner][ rectangular] terrazzo 12" high basin with 2" shoulders and overall basin size of [24" x 24"][32" x 32"][36" x 36"][36" x 24"] [with drop front]. Furnish with factory installed 3" drain body with removable stainless steel strainer. Furnish with [manufacture's standard mop hanger, two stainless steel wall shields, and hose and horse bracket accessories for field installation. Fiat Model <Insert Model Number Here> or equivalent. Provide F-2 faucet as specified in the Articles below.

2.8 DRINKING FOUNTAINS

A. DF-1 Drinking Fountains (Barrier-Free): Two-level wall mounted, barrier free access drinking fountains with stainless steel surface mounting plate, 18 gage Type 304 stainless steel bowls with flexible safety bubbler and 16 gage Type 304 tubular stainless steel bowl support arms with vandal-resistant front push button. Include in-line flow regulator from 20 to 105 psi, mounting hangers, and access panels for p-trap and supply stop access. Provide P-trap and supply with stop. Elkay Model EDFPBM117C or equivalent.

1. Include optional trap and shutoff valve access panels.
B. DF-1  Drinking Fountains (Barrier-Free): Two-level wall mounted, barrier free access drinking fountain with stainless steel surface mounting plate, 18 gage Type 304 stainless steel contoured bowls with flexible safety bubbler and vandal-resistant front push button. Include in-line flow regulator from 20 to 105 psi, and wall hanger. Provide P-trap and supply with stop. Elkay Model EDFP217C or equivalent.

1. [Provide Elkay Model 97258C ] or equivalent Thermo-formed textured ABS plastic apron accessory designed to bring water coolers into compliance with the Americans with Disabilities Act (A.D.A.) when units are mounted on an exposed wall.

C. DF-1  Drinking Fountain (Barrier-Free): Wall mounted, self-contained barrier free access drinking fountain. Flexible safety bubbler and hand operated self-closing push-bar controls located on front, left and right side panels of cabinet, flow regulator from 20 to 100 psi, mounting hangers, stainless steel basin. Provide 1 1/4” P-trap and supply with stop. Elkay Model EZSD or equivalent. When installed in pairs, mount unit indicated on drawings as barrier free at barrier free elevations and other unit at standard elevation. Refer to mounting height schedule.

1. [Provide Elkay Model LKAPREZL ] or equivalent Thermo-formed textured ABS plastic apron accessory with bottom cover plate designed to bring water coolers into compliance with the Americans with Disabilities Act (A.D.A.) when units are mounted on an exposed wall.

D. DF-1  Drinking Fountains (Barrier-Free): Two-level wall mounted, barrier free access drinking fountain with capacity of 8 GPH of 50°F drinking water at 80°F inlet and 90°F ambient. Hand operated, flexible safety bubbler and self-closing push-bar controls located on front and side of cabinet, flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, cabinet shall be steel with manufacturers standard finish, and 115/1/60 power. Provide P-trap and supply with stop. Elkay Model EZSTDDC or equivalent.

E. EWC-1  Electric Water Coolers (Barrier-Free): Two-level vandal resistant wall mounted, barrier free access drinking fountain. Include push button hand operator, vandal resistant bubbler, and flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, and cabinets. Provide P-trap and supply with stop. Elkay Model VRCTLDSC or equivalent.

1. Provide stainless steel apron accessory designed to bring water coolers into compliance with the Americans with Disabilities Act (A.D.A.) when units are mounted on an exposed wall.

F. DF-1  Drinking Fountains (Barrier-Free): Wall mounted, barrier free access freeze resistant drinking fountain with stainless steel surface mounting plate, 14 gage series 300 stainless steel contoured bowl with vandal-resistant bubbler and vandal-resistant front push button, freeze resistant system with back wall box to house water connection and trap inside building. Include in-line flow regulator from 20 to 105 psi, and wall hanger. Provide P-trap and supply with stop. Halsey-Taylor Model HDFEBP-FR or equivalent.

G. DF-2  Drinking Fountains (Barrier-Free): Wall mounted, barrier free access drinking fountain with stainless steel surface mounting plate, 14 gage series 300 stainless steel contoured bowl with vandal-resistant bubbler and vandal-resistant front push button. Include in-line flow regulator from 20 to 105 psi, and wall hanger. Provide P-trap and supply with stop. Halsey-Taylor Model HDFEBP or equivalent.
2.9 ELECTRIC WATER COOLERS

A. EWC-1 Electric Water Coolers (Barrier-Free): Single, Wall mounted, self-contained barrier free access electric water cooler with fully sealed hermetic refrigeration system. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Hand operated, flexible safety bubbler and self-closing push-bar controls located on front and side panels of cabinet, flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins. Refrigeration system is located below basin, 115/1/60 compressor. Provide 1 1/4" P-trap and supply with stop. Elkay Model EZS8 or equivalent. When installed in pairs, mount unit indicated on drawings as barrier free at barrier free elevations and other unit at standard elevation. Refer to mounting height schedule.

B. EWC-2 Electric Water Coolers (Barrier-Free): Two-level wall mounted, self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Hand operated, flexible safety bubbler and self-closing push-bar controls located on front and side panels of cabinet, flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, cabinet shall be steel with manufacturers standard finish. Refrigeration system is located below basin, 115/1/60 compressor. Provide P-trap and supply with stop. Elkay Model EZSTL8C or equivalent.

C. EWC-3 Electric Water Coolers (Barrier-Free): Two-level wall mounted, stainless steel self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system. Capacity 7.5 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Contoured stainless steel basins with tubular support arms, flexible safety bubbler front push button, flow regulator from 20 to 100 psi, filter system, and mounting frame. Provide P-traps and supply with stop. Elkay Model ERPBM28K or equivalent.

D. EWC-1 Electric Water Coolers (Barrier-Free): Two-level wall mounted, stainless steel self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system, filter, and bottle fill station. Capacity 8.0 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Contoured stainless steel basins with tubular support arms, flexible safety bubbler front push button, flow regulator from 20 to 100 psi, filter system, and mounting frame. Provide P-traps and supply with stop. Elkay Model LZWS-LRPBM28K.

E. EWC-2 Electric Water Cooler/Bottle Fill Station: Wall mounted, self-contained barrier free access electric water cooler with fully sealed hermetic refrigeration system. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Hand operated, flexible safety bubbler and self-closing push-bar controls located on front, left and right side panels of cabinet, flow regulator from 20 to 100 psi, mounting hangers, stainless steel basin. Refrigeration system is located below basin, 115/1/60 compressor. Provide 1 1/4" P-trap and supply with stop. Bottle filling station shall include electronic sensor for activation with 20 second shut-off timer; 1.1 GPM laminar flow outlet; and stainless steel and anti-microbial plastic housing. Elkay Model E7S8WSLK. Refer to mounting height schedule.
F. EWC-1  Electric Water Coolers (Barrier-Free): Two-level wall mounted, self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system and bottle fill station. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Include front and side push-bar hand operators, flex-guard bubbler, and flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, and cabinet shall be steel with manufacturers standard finish. Bottle filler shall provide 1.1 gpm flow rate with laminar flow to minimize splashing and include the minimum 3000-gallon capacity filter with visual monitor to indicate when replacement is necessary. Unit shall include integrated silver ion anti-microbial protection in key areas. Refrigeration system is located below basin, 115/1/60 compressor. Provide P-trap and supply with stop. Elkay Model LZSTL8WSLK or equivalent.

G. EWC-1  Electric Water Coolers (Barrier-Free): Two-level vandal resistant wall mounted, self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system. Capacity 7.8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Include push button hand operator, bubbler, and flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, and stainless steel construction. Refrigeration system is located below basin, 115/1/60 compressor. Provide P-trap and supply with stop. Elkay Model VRCTL8SC or equivalent.

1. Provide stainless steel apron accessory designed to bring water coolers into compliance with the Americans with Disabilities Act (A.D.A.) when units are mounted on an exposed wall.

H. EWC-1  Electric Water Coolers (Barrier-Free): Two-level vandal resistant wall mounted, self-contained barrier free access electric water coolers with fully sealed hermetic refrigeration system and bottle fill station. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Include push button hand operator, bubbler, and flow regulator from 20 to 100 psi, mounting hangers, stainless steel basins, and 14 gauge stainless steel construction. Bottle filler shall provide 1.1 gpm flow rate with laminar flow to minimize splashing and include the minimum 3000-gallon capacity filter with visual monitor to indicate when replacement is necessary. Unit shall include integrated silver ion anti-microbial protection in key areas. Refrigeration system is located below basin, 115/1/60 compressor. Provide P-trap and supply with stop. Elkay Model VRCHD8L8SC or equivalent.

1. Provide stainless steel apron accessory designed to bring water coolers into compliance with the Americans with Disabilities Act (A.D.A.) when units are mounted on an exposed wall.

2.10 BOTTLE FILL STATIONS – STAND ALONE

A. BFS-1  Electric Cooled Bottle Fill Station (Barrier-Free): Wall mounted, self-contained barrier free access electric water cooler bottle fill station with fully sealed hermetic refrigeration system. Capacity 8 GPH of 50°F drinking water, 80°F inlet and 90°F ambient. Bottle filling station shall include electronic sensor for activation with 20 second shut-off timer; 1.1 GPM laminar flow outlet; and stainless steel and anti-microbial plastic housing, filter system, and mounting frame. Refrigeration system is located below basin, 115/1/60 compressor. Provide 1 1/4" P-trap and supply with stop. Elkay Model EZWSM8K or equivalent.
2.11 SERVICE SINKS

A. SS-1 Service Sink: Size 24" x 20" acid resistant enameled cast iron [with blank back], stainless steel rim guard, wall hanger support, 3" trap standard with clean out plug and chrome plated strainer. American Standard "Akron" Model 7695.000 or equivalent. Provide F-2 faucet as specified in articles below.

B. SS-1 Service Sink: Size 24" x 20" acid resistant enameled cast iron [with two holes on 8" centers on back], stainless steel rim guard, wall hanger support, 3" trap standard with clean out plug and chrome plated strainer. American Standard "Akron" Model 7695.008 or equivalent. Provide F-2 faucet as specified in articles below.

C. SS-2 Clinic Service Sink: Vitreous china, blow-out action wall hung sink with flushing rim,[ one][ two][ three] rim guard[s] and 1-1/2" top spud. American Standard Model 9512.999.020. Provide carriers, FV-2 flush valve, F-8 faucet and BPW-1 bedpan washer as specified in the Articles below.

2.12 BATH TUBS

A. BT-1 Bathtubs: One piece unit, 60" long x minimum 30"wide for 3 wall alcove installation; constructed of "Americast" engineered material, cast iron, or porcelain enameled steel; white in color, self-supported, and having straight tiling edges with full wall flange and enclosed corner flange, straight apron floor line, slip resistant bottom surface, and combination pop-up waste with overflow. American Standard "Cambridge", Model 2460.002 or equivalent. Provide F-8 tub/shower faucet as specified in the Articles below.

B. BT-1 Bathtubs: One piece constructed, enameled cast iron, recessed bath; white in color, self-supported by a 32" x 16" x 2" sound suppressing base pad, and having straight tiling edges with full wall flange and enclosed corner flange, straight apron floor line, slip resistant bottom surface conforming with ASTM F-462, and combination pop-up waste with overflow. American Standard "Spectra", Model 2607.109 or equivalent. Provide F-9 faucet as specified in the Articles below.

C. BT-2 Bathtubs (Barrier-Free): One piece constructed, enameled cast iron, recessed bath; white in color, self-supported, and having straight tiling edges with full wall flange and enclosed corner flange, straight apron floor line, slip resistant bottom surface conforming with ASTM F-462, and combination pop-up waste with overflow. American Standard "Solar", Model 0163.060, 0165.060, or equivalent. Provide F-15 faucet as specified in the Articles below.

D. BT-3 Bathtubs: ARJO Freedom Bath Model AFB2104-04 bathing and hydromassage unit including the following:

1. One piece fiberglass reinforced polyester laminate with gel-coat finish, and adjustable leveling legs.
2. Counter balanced flexible full width and height manual roll-up door.
3. Valance mounted control panel.
4. Hydromassage system with electric motor driven centrifugal pump and adjustable jets.
5. UL Standard 1795 certified.
6. ARJO Model AFA0200-US water control system with the following:
   a. Thermostatic mixing valve with stop and check valves.
   b. Wall mounted adjustable hand held shower with backflow protection and ¾" tube spout.
2.13 WASHFOUNTAINS

A. WF-1 Washfountains: Two station wall hung lavatory system with two lavatories, pedestal, stainless steel mounting frame, infrared sensors, low voltage transformer, solenoid valve, liquid soap dispenser, supply fittings, and thermostatic mixing valve with combination stop, strainer, and check valves. Bradley Express Lavatory System Model SS-2/IR/WH97 or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.

B. WF-2 Washfountains: Three station wall hung lavatory system with three lavatories, pedestal, stainless steel mounting frame, infrared sensors, low voltage transformer, solenoid valve, liquid soap dispenser, supply fittings, and thermostatic mixing valve with combination stop, strainer, and check valves. Bradley Express Lavatory System Model SS-3/IR/WH97 or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.

C. WF-1 Washfountains: Foot operated 54” semi-circular with supplies through wall below basin and waste through floor with vent through wall below basin. Unit shall be complete with white marble "Bradstone" bowl, gray pedestal panels and all standard equipment, including nylon liquid soap dispenser. Bradley Model 2804F or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.

D. WF-2 Washfountains(Barrier-Free): Air valve metering control four fountain floor mounted washfountain with supplies and waste through wall below basin. Unit shall be complete with stain resistant composite material bowl, pedestal, front access panel, adjustable ASSE Standard 1016 certified thermostatic mixing valve, and all standard equipment. Bradley Model 2944AST or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.

E. WF-3 Washfountains(Barrier-Free): Air valve metering control three fountain floor mounted washfountain with supplies and waste through wall below basin. Unit shall be complete with stain resistant composite material bowl, pedestal, front access panel, adjustable ASSE Standard 1016 certified thermostatic mixing valve, and all standard equipment. Bradley Model 2933AST or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.

F. WF-4 Washfountains: Air valve metering control three fountain floor mounted washfountain with supplies and waste through wall below basin. Unit shall be complete with stain resistant composite material bowl, juvenile height pedestal, front access panel, adjustable ASSE Standard 1016 certified thermostatic mixing valve, and all standard equipment. Bradley Model 2933AST-Juvenile Height or equivalent.

1. Color to be selected by Architect from manufacturer's full range, including designer and specialty colors.
2.14 EMERGENCY EQUIPMENT

A. EW/ES-1 Emergency Eye-Wash and Shower Station (Barrier-Free): Drench type with shower head, instant-action stay-open manually closed chrome plated brass ball shower valve with rigid stainless steel pull-rod and triangular handle, galvanized pipe standard with corrosion-resistant green coating and floor flange, corrosion-resistant eye/face-wash bowl with soft flow head(s), instant-action stay-open chrome plated brass ball eye-wash valve with push-flag operation. Placement of shower head, pull-rod, and eyewash bowl shall accommodate wheelchair user. Guardian Model GBF1909 or equivalent.

1. Provide ANSI Z 358.1 compliant emergency equipment tempering thermostatic mixing valve on water lines to unit. Install valve in surface mounted wall cabinet.

B. EEW-1 Emergency Swing-Away Eyewash: Countertop mounted chrome plated swing away eyewash with push-flag operation stay open ball valve: brass twin spray head assembly with covers; and identification sign and inspection tag. Bradley Model S19-270B or equivalent.

1. Provide thermostatic mixing valve on water lines to all eyewash. Refer to Section 22 1119 for mixing valve.

C. EW/ES-1 Emergency Eye-Wash and Shower Station (Barrier-Free): Drench type with shower head, instant-action stay-open manually closed chrome plated brass ball shower valve with rigid stainless steel pull-rod and triangular handle, galvanized pipe standard with corrosion-resistant coating and floor flange, corrosion-resistant eye/face-wash bowl with soft flow head(s), instant-action stay-open chrome plated brass ball eye-wash valve with push-flag operation. Placement of shower head, pull-rod, and eyewash bowl shall accommodate wheelchair user. Bradley Model S19-310BF or equivalent.

D. ESH-1 Emergency Shower and Eye-Wash Station (Barrier-Free): Recessed mounted stainless steel drench shower and eyewash, with pull down stainless steel eye-wash bowl and ceiling flush mounted stainless steel shower head with push-flag operation. Bradley Model S19-315FBF or equivalent.

E. ESH-1 Emergency Showers: Emergency, drench type, having 10" diameter stainless steel shower head, 1" I.P.S. rough chrome plated, brass ball valve, chrome plated pipe and fittings, and polished chrome plated rigid pull rod and triangular handle. Bradley Model S19-120T or equivalent.

F. EEW-1 Emergency Eyewash Fountains: Wall mounted stainless steel receptor with integral stainless steel mounting bracket. Unit shall have stainless steel face spray ring; push-flag type, instant action, ball valve that stays open until manually closed; pressure compensated stream control; and chrome plated strainer and tailpiece. Bradley Model S19-220SS or equivalent. Provide complete with trap, and supplies and stops as specified in the Articles below.

G. EST-1 Emergency Shower and Eye-Wash Station: Drench type with stainless steel shower head, instant-action stay-open manually closed chrome plated brass ball shower valve with rigid stainless steel pull-rod and triangular handle, galvanized pipe standard with floor flange, corrosion-resistant stainless steel eye-wash bowl with twin covered soft flow heads, instant-action stay open chrome plated brass ball eye-wash valve with push-flag operation. Bradley Model S19-310F or equivalent.

H. EST-2 Emergency Shower and Eye-Wash Station (Barrier-Free): Drench type with stainless steel shower head, instant-action stay-open manually closed chrome plated brass ball shower...
valve with rigid stainless steel pull-rod and triangular handle, galvanized pipe standard with floor
flange, corrosion-resistant stainless steel eye-wash bowl with twin covered soft flow heads,
instant-action stay-open chrome plated brass ball eye-wash valve with push-flag operation.
Placement of shower head, pull-rod, and eyewash bowl shall accommodate wheelchair user.
Bradley Model S19-310BF or equivalent.

2.15 SHOWERS

2.16
A. SH-1 Shower Assembly (Barrier-Free): ASSE 1016 balanced pressure mixing shower valve
   with single lever blade handle. Valve shall open to cold water first and then through warm (mix)
to hot. Valve shall have all operating parts separately replaceable from outside of wall through
valve cover plate, ceramic disc valve cartridge, adjustable safety limit stop (set at 110°F),
screwdriver stops, 2-way diverter valve, wall supply with 1.5 gpm shower head, inline vacuum
breaker, and 1.5 gpm hand held shower head with 36" slide bar and 60" hose. All exposed
surfaces shall be chrome-plated. American Standard Model 1662.211 or equivalent.

B. SH-1 Shower Assembly (Barrier-Free): ASSE 1016 balanced pressure mixing shower valve
   with single lever blade handle. Valve shall open to cold water first and then through warm (mix)
to hot. Valve shall have all operating parts separately replaceable from outside of wall through
valve cover plate, ceramic disc valve cartridge, adjustable safety limit stop (set at 110°F),
screwdriver stops, wall supply, inline vacuum breaker, and 1.5 gpm hand held shower head with
36" slide bar and 60" hose. All exposed surfaces shall be chrome-plated. American Standard
Model 1662.211 or equivalent.

C. SH-1 Shower Assembly (Barrier-Free): ASSE 1016 balanced pressure mixing shower valve
   with single lever blade handle. Valve shall open to cold water first and then through warm (mix)
to hot. Valve shall have all operating parts separately replaceable from outside of wall through
valve cover plate, ceramic disc valve cartridge, adjustable safety limit stop (set at 110°F),
screwdriver stops, wall supply, inline vacuum breaker, and 2.5 gpm hand held shower head with
[36" slide bar and 60" hose]. All exposed surfaces shall be chrome-plated. American Standard
Model 1662.601 with 1660.236 slide bar or equivalent.

D. SH-1 Shower Valve: ASSE 1016 pressure balance mixer type shower valve with single metal
   blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve
shall have operating parts separately replaceable from outside the wall through valve cover
plate, with ceramic disc valving, adjustable safety limit stop, and screw driver stops. Provide
complete with chrome plated shower arm with escutcheon and maximum 1.75 gpm shower
head. Zurn Z7301-SS-MT-S9 or equivalent.

E. SH-1 Shower Valve (Barrier-Free): ASSE 1016 balanced pressure mixer type shower valve
   with single metal blade handle. Valve shall open to cold water first and then through warm (mix)
to hot. Valve shall have operating parts separately replaceable from outside the wall through
valve cover plate with ceramic disc valving, adjustable safety limit stop and check stops.
Provide complete with chrome plated shower arm with escutcheon, hand held shower head with
36" slide bar and 60" hose. Zurn Z7300-SS-HW-MT or equivalent.

F. SH-1 Shower Assembly (Barrier-Free): Balanced pressure mixing shower valve with single
   lever blade handle. Valve shall open to cold water first and then through warm (mix) to hot.
Valve shall have all operating parts separately replaceable from outside of wall through valve cover plate, ceramic disc valve cartridge, adjustable safety limit stop (set at 110°F), screwdriver stops, wall supply, inline vacuum breaker, and 2.5 gpm hand held shower head with 36" slide bar and 60" hose. All exposed surfaces shall be chrome-plated. American Standard Model 1662.601 or equivalent.

G. SH-3 Shower Assembly (Barrier-Free): Balanced pressure mixing shower valve with single lever blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have all operating parts separately replaceable from outside of wall through valve cover plate, ceramic disc valve cartridge, adjustable safety limit stop (set at 110°F), screwdriver stops, wall supply, inline vacuum breaker, and 2.5 gpm hand held shower head with 36" slide bar and 60" hose. All exposed surfaces shall be chrome-plated. American Standard Model 1662.601 or equivalent.

H. SH-3 Column Showers: Type 304 stainless steel column showers for five users with supplies from above and vent off line. All exposed stainless steel parts shall have No. 4 finish and all exposed brass components shall be chrome plated. Showers shall be complete with circular soap tray, touch and flow metering valves, vandal-proof showerheads mounted at 6'-0", and telescoping shroud to conceal overhead piping up to 9'-0" ceiling. Bradley Model 5C0 or equivalent.

I. SH-4 Shower Panels: Vertical surface mounted wall shower panel, constructed of Type 304 stainless steel, complete with end panels, shower head, and shower valve. Shower heads shall be severe service fixed type with 2.5 gpm flow control. Shower valves shall be mechanical metering type with 50 to 70 second duration timing cartridge. Symmons Hydapipe System or equivalent.

1. Provide vertical stainless steel shroud up to ceiling.
2. Provide horizontal stainless steel pipe cover complete with end panels and corner sections.

J. SH-5 Prefabricated Modular Shower System: Wall mounted panel system constructed of Type 304 stainless steel, complete with end panels, access panels, corner sections, shower heads, shower valves and Type "L" copper supply piping with wrought copper or cast brass fittings. Shower heads shall be severe service fixed type with 2.5 gpm flow control. Shower valves shall be Touch‘N Flo metering type with 50 to 70 second duration timing cartridge. Shower head mounting heights shall be 6'-0" for males, 5'-6" for females. Bradley Model 1PA or equivalent by Acorn.

K. SH-6 Shower Assembly (Barrier-Free): ADA compliant one piece acrylic shower module with nominal 36" x 36" inside dimensions, white in color, with grab bars, standard fold-up seat, curtain rod, shower drain, pressure balanced single lever shower mixing valve, hand held shower head, 60" flexible hose, and 36" slide guide.

L. SH-1 Shower Panels (Barrier-Free): Vertical recessed mounted wall shower panel, constructed of Type 304 stainless steel, including pressure balancing valve with service stops and handle turn limits; fre-flo all brass fixed spray vandal resistant shower head; diverter valve with volume control; hand spray with 60" flexible hose and 36" slide bar; in-line vacuum breaker; less soap dish. Symmons Hydapipe System Model 1-912RS-FSB-285-Delete S or equivalent.

M. SH-2 Shower Panels: Vertical recessed mounted wall shower panel, constructed of Type 304 stainless steel, including pressure balancing valve with service stops and handle turn limits; fre-
flo all brass fixed spray vandal resistant shower head; less soap dish. Symmons Hydapipe System Model 1-911RS-Delete S or equivalent.

N. SH-1: Shower Module: One piece acrylic or fiberglass shower module with nominal 36” x 36” dimensions, white in color, with shower drain. Lasco Model 1343C or equivalent.

1. Shower Valve and Head: ASSE 1016 pressure balance mixer type shower valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate, with ceramic disc valving, adjustable safety limit stop, and screw driver stops. Provide complete with chrome plated shower arm with escutcheon and maximum 1.75 gpm shower head. Zurn Z7301-SS-MT-S8 or equivalent.

2.17 SINKS

DESIGNER NOTE: These are basic sinks for break room, and kitchenette use. They may be used in a drop-in or undermount configuration as the project requires. Discuss the use of garbage disposals.

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to [barrier-free] sink faucet. Mount below lavatory as high as possible. Refer to Section 22 1119 for mixing valve.
3. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.
4. Provide plastic under lavatory trap and supplies shield on barrier-free units. Refer to articles below.
5. Provide Insinkerator “Badger-1” garbage disposer, complete with on/off wall switch, 120v 1/3 horsepower motor, and dishwasher connection kit.
6. Mount EEW-1 eyewash next to bowl and provide thermostatic mixing valve on water lines to eyewash. Mount below sink within casework. Refer to Section 22 1119 for mixing valve.
7. Provide thermostatic mixing valve on hot water line to sink faucet. Mount below sink within casework. Refer to Section 22 1119 for mixing valve.
8. Provide thermostatic mixing valve on hot water line to sink faucet. Mount below sink within [knee board]. Refer to Section 22 1119 for mixing valve.

B. SK-1 Stainless Steel Sinks: 17” x 20” x 7-1/2” self-rimming single compartment sink, with LKVR18B vandal resistant stainless steel grid strainer and 1-1/2” O.D. tailpiece; drilled for 8” center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model LR-1720 or equivalent.

C. SK-2 Stainless Steel Sinks: 22” x 19-1/2” x 7-1/2” self-rimming, single compartment sink, with LK-99 stainless steel crumb cup strainer with rubber stopper and 1-1/2” O.D. chrome plated brass tailpiece; drilled for 8” center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finish exposed surfaces in accordance with ASTM A 480 No. 4 finish, and sound deaden by undercoating underside. Elkay Model LR-2219 or equivalent. Provide F-4 faucet, trap, and supplies and stops as specified in the Articles below.
D. SK-3 Stainless Steel Sinks: 19 1/2" x 19" x 10" self-rimming, single compartment sink with LK-99 stainless steel crumb cup strainer with rubber seat stopper, and 1-1/2" O.D. chrome plated brass tailpiece; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model DLR-1919-10 or equivalent. Provide F-4 faucet, traps, supplies and stops as specified in the Articles below.

E. SK-4 Stainless Steel Sinks: 29" x 18" x 7-1/2" self-rimming, double compartment sink, with LK-99 stainless steel crumb cup strainers with rubber seat stopper, and 1-1/2" O.D. chrome plated brass tailpieces; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model LR-2918 or equivalent. Provide F-4 faucet, trap, and supplies and stops as specified in the Articles below.

F. SK-5 Stainless Steel Sinks: 33" x 22" x 10" self-rimming, double compartment sink, with LK-99 stainless steel crumb cup strainers with rubber seat stopper, and 1-1/2" O.D. chrome plated brass tailpieces. Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model DLR-3322-10 or equivalent. Provide F-4 faucet, trap, and supplies and stops as specified in the Articles below.

G. SK-2 Stainless Steel Sinks (Barrier-Free): 17" x 20" x 5-1/2" deep self-rimming single compartment sink, with center back drain location; LKVR18B vandal resistant stainless steel grid strainer and 1-1/2" O.D. offset tailpiece; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model LRAD-1720 or equivalent.

1. Provide thermostatic mixing valve on hot water line to barrier-free sink faucet. Mount below sink within [kneeboard]. Refer to Section 22 1119 for mixing valve.

2. Provide thermostatic mixing valve on hot water line to barrier-free sink faucet. Mount below [lavatory as high as possible]. Refer to Section 22 1119 for mixing valve.

3. Provide plastic under lavatory trap and supplies [insulation kit on barrier-free units]. Refer to articles below.

H. SK-4 Stainless Steel Sinks (Barrier-Free): 22" x 22" x 6" deep self-rimming, single compartment sink, with center back drain location; LKAD-18 chrome plated brass grid drain/1-1/2" offset tailpiece; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model LRAD-2222 or equivalent. Provide F-7 faucet, trap, and supplies and stops as specified in the Articles below.

1. Provide thermostatic mixing valve on hot water line to barrier-free sink faucet. Mount below sink within trap cover. Refer to Section 22 1119 for mixing valve.

I. SK-3 Stainless Steel Sinks (Barrier-Free): 33" x 21-1/4" x 6" deep self-rimming, double compartment sink, with center back drain location; LK-99 stainless steel crumb cup strainers with rubber seat stopper, and 1 1/2" O.D. chrome plated brass tailpieces; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model LRAD 3321 or equivalent.

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to barrier-free sink faucet. Mount below sink within trap cover. Refer to Section 22 1119 for mixing valve.

J. SK-8 Stainless Steel Sinks with Bubbler: 37-1/4" x 17" x 7-1/2" self-rimming, rectangular fountain bowl with sink, with LK-18B and LK-8 chrome plated brass grid strainers and 1-1/2" O.D. chrome plated brass tailpieces; drill sink for 8" center faucet and bubbler (4 total holes required). Fabricate sink from 18 gage, Type 304 stainless steel, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model DRKR-3717 or equivalent. Provide F-3 faucet and bubbler, supplies, traps, and stops as specified in the Articles below.

K. SK-9 Stainless Steel Sinks with Bubbler: 25" x 22" x 7-1/2" self-rimming, rectangular bowl with sink, with LK-18 chrome plated brass grid strainer and 1-1/2" O.D. chrome plated brass tailpiece; drill sink for 8" center faucet and bubbler (4 total holes required). Fabricate sink from 18 gage, Type 304 stainless steel, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model DRKR-2522 or equivalent. Provide F-3 faucet and bubbler, supplies, traps, and stops as specified in the Articles below.

L. SK-9 Stainless Steel Sinks with Bubbler (Barrier-free): 25" x 22" x 6" self-rimming, rectangular bowl with sink, with LKAD-18 chrome plated brass grid drain/1-1/2" offset tailpiece; drill sink for 8" center faucet and bubbler (4 total holes required). Fabricate sink from 18 gage, Type 304 stainless steel, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model DRKAD-2522 or equivalent. Provide F-3 faucet and bubbler, supplies, traps, and stops as specified in the Articles below.

1. Provide thermostatic mixing valve on hot water line to barrier-free sink faucet. Mount below sink within trap cover. Refer to Section 22 1119 for mixing valve.

M. SK-10 Kitchen Hand Wash Sink: 22" x 19" rectangular single compartment 18 gage Type 304 stainless steel hand wash sink. Wall mounted, minimum 2-1/2" splash back, front and side decks with raised rim, drilled for 8" center faucet, with 1-1/2" O.D. Chrome plated tailpiece with fixed strainer. Elkay Model ELV-2219 or equivalent. Provide F-6 faucet, carrier, trap, and supplies and stops as specified in Articles Below.

N. SK-11 Stainless Steel Sink: 51" x 27-1/2" x 14" double compartment sink, two 24" x 24" x 14" basins, 8" splash guard, type 304, 14 gauge stainless steel construction, seamless welded 1/4" radius covered corners, stainless steel tubular legs, NSF seal of approval, uniform satin luster finish. Provide 3-1/2" hole in center of each basin, with stainless steel perforated strainer and 1 1/2" chrome plated tailpiece. Drill splash guard for 8" center faucets. Sink rim 36" above floor. Elkay Model WNSF-8248 or equivalent. Provide F-10 faucet, supplies and stops as specified in the articles below. Tie drain lines together and route to solids interceptor as indicated on drawings.

O. SK-12 Stainless Steel Service Sinks: 25" x 19-1/2" x 12" wall mounted service sink with one piece wall hanger, stainless steel support bracket and 3" cast iron P-trap standard with chrome plated metal strainer. Fabricate sink from 14-gage, Type 304 stainless steel with covered corners and rolled rim. Exposed surfaces shall be finished in accordance with ASTM A-480, No. 4 finish. Elkay Model ESSW-2520 or equivalent. Provide F-2 faucet, and supplies and stops as specified in the Articles below.

P. SK-13 Fiberglass Utility Sink: 24" x 24" x 14" deep nominal fiberglass or thermoplastic utility sink, white in color, molded in soap tray with 4" centered faucet knockouts, rust-free legs with
level adjusting feet, and integral molded drain outlet. Florestone Model FM or equivalent. Provide F-7 faucet, trap, supplies and stops as specified in the Articles below.

Q. SK-14 Custom Stainless Steel Sink: 30" x 60" double compartment sink, two 16" x 16" x 10" basins, 4" splash guard, type 304, 14 gauge stainless steel construction, seamless welded 1/4" radius covered corners, stainless steel tubular legs, uniform satin luster finish. Provide 3-1/2" hole in center of each basin, with stainless steel perforated strainer and 1-1/2" tailpiece. Drill top for one 8" center set faucet. Sink rim 36" above floor. Provide F-7 faucet, trap, supplies and stops as specified in the articles below.

R. SK-15 Stainless Steel Sink: 102" x 27-1/2" x 14" triple compartment sink with two drain boards, three 18" x 24" x 14" basins, 8" splash guard, type 304, 14 gauge stainless steel construction, seamless welded 1/4" radius covered corners, stainless steel tubular legs, NSF seal of approval, uniform satin luster finish. Provide 3-1/2" hole in center of each basin, with stainless steel perforated strainer and roto handle waste fitting. Drill splash guard for two 8" center faucets. Sink rim 36" above floor. Elkay Model WNSF 8354 or equivalent. Provide F-4 faucet, supplies and stops as specified in the articles below.

S. SK-16 Shampoo Sink: Acrylic wall mounted shampoo sink complete with mounting bracket, temperature control faucet, vacuum breaker, flexible hose with spray head, and strainer drain assembly. Belvedere Model 2800 or equivalent.

T. SK-3 Stainless Steel Sinks: 22-1/2" x 17-1/4" x 7-1/2" undermount, single compartment sink with LKVR-18B stainless steel grid strainer and 1-1/2" O.D. chrome plated brass tailpiece; mounted in solid surface countertop. Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model ELUH-2115 or equivalent. Provide F-4 faucet, trap, and supplies and stops as specified in the Articles below.

1. Mount using “overhang” installation profile.
2. Provide thermostatic mixing valve on hot water line to sink faucet. Mount below sink within casework. Refer to Section 22 119 for mixing valve.
3. Provide solids interceptor for sink drain. Mount below sink within casework. Refer to Section 22 1319 for interceptor.

U. SK-4 Stainless Steel Sinks: 29-1/2" x 17-1/2" x 7-1/2" undermount, single compartment sink with LKVR-18B stainless steel grid strainer and 1-1/2" O.D. chrome plated brass tailpiece; mounted in solid surface countertop. Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model ELUH-2816 or equivalent. Provide two F-4 faucets (for countertop mounting – one each end), trap, and supplies and stops as specified in the Articles below.

1. Mount using “overhang” installation profile.
2. Provide thermostatic mixing valve on hot water line to each sink faucet. Mount below sink within casework. Refer to Section 22 119 for mixing valve.
3. Provide solids interceptor for sink drain. Mount below sink within casework. Refer to Section 22 1319 for interceptor.
2.18 WHIRLPOOL BATHTUBS

A. WP-1 Whirlpool Bathtubs (Barrier-Free): One piece constructed, 32" x 60" enameled cast iron, white in color, straight tiling edges with full wall flange and enclosed corner flange, straight apron floor line, slip-resistant bottom surface conforming with ASTM F-462, whirlpool trim kit, grab rails, and combination pop-up waste with overflow. Kohler "Guardian" Model K-783-H or equivalent. Provide "Type-I" faucet as specified in the Articles below.

2.19 SCRUB SINK

A. SSS-1 Surgeon's Scrub Sink: Vitreous china, wall hung sink with single hole and 1-1/2" grid drain. American Standard Model 9047.093. Provide painted wall bracket supports, F-4 faucet, trap, and supplies and stops as specified in the Articles below.

2.20 BEDPAN WASHERS

A. BPW-1 Bedpan Washer: Wall-mounting bedpan washer with supply with 48-inch- long rubber or vinyl hose, wall bracket and hook, and spray nozzle. Include supply stop; wall-mounting ASSE 1001 vacuum breaker; and polished chrome-plated finish on metal parts exposed after installation. Chicago Faucet Model 809-CP or equivalent.

B. BPW-1 Bedpan Washer: Wall-mounting, hand-held, hand-control-valve bedpan washer with supply with 48-inch- long rubber or vinyl hose, wall bracket and hook, self-closing valve, and spray nozzle. Include loose-key supply stop; wall-mounting, ASSE 1001 vacuum breaker; and polished, chrome-plated finish on metal parts exposed after installation. Chicago Faucet Model 809-777-21K 809-CP or equivalent.

C. BPW-2 Bedpan Washer: Wall-mounting foot-control, single, long-pedal-valve bedpan washer with supply with 48-inch- long rubber or vinyl hose, wall bracket and hook, self-closing valve, and spray nozzle. Include loose-key supply stop; wall-mounting, ASSE 1001 vacuum breaker; and polished, chrome-plated finish on metal parts exposed after installation.

D. BPW-3 Bedpan Washer: Wall-mounting, foot-control, double, long-pedal-valve, bedpan washer with supply with 48-inch- long rubber or vinyl hose, wall bracket and hook, self-closing valve, and spray nozzle. Include loose-key supply stop; wall-mounting, ASSE 1001 vacuum breaker; and polished, chrome-plated finish on metal parts exposed after installation.

2.21 SECURITY FIXTURES

A. SL/WC-1 Lavatory/Toilet Combination Units: Provide Acorn or equivalent Penal-Ware 18" wide off-floor Lav-Toilet Comby Model Number 1418. Fixture shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Countertop shall have a multiside lavatory bowl and an air-circulating, self-draining soap dish. Toilet shall be blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish. Toilet trap shall pass a 2-5/8" diameter ball and be fully enclosed. Cabinet interior is sound-deadened with fire-resistant material. Fixture shall withstand loadings of 5000 pounds without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation, penal bubbler, hot and cold air-trol valve with 1/2 GPM flow control, pneumatically operated pushbutton valves,
metering non-hold open type with 1/2 GPM flow control, flood-trol anti-flood system, flush valve with through wall connector, paper holder, lavatory extension with P-trap and cleanout, and wall sleeve.

B. SWC-1 Toilets (wall mounted): Provide Acorn or equivalent Penal-Ware Compact Blowout Jet Toilet Model Number 1679. Fixture shall be fabricated from 14 gage type 304 stainless steel. Construction shall be seamless welded and all exposed parts polished to a satin finish, except integral contoured toilet seat which shall be sanitary high polish finish. Toilet shall have an elongated bowl and a self-draining flushing rim. Toilet trap shall pass a 2-5/8" diameter ball and be fully enclosed. Fixture shall withstand loadings of 3000 pounds without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation, concealed wall supply, off-floor wall outlet, flood-trol anti-flood system, hydraulically activated flush valve with through wall connector, and wall sleeve.

C. SLAV-1 Lavatories: Provide Acorn or equivalent Penal-Ware 18" wide Handicapped Lavatory with Oval Bowl Model Number 1652 (non-ADA cabinet). Fixture shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Counter-top shall have an air-circulating, self-draining soap dish. Fixture shall have hot and cold Air-Trol pneumatically operated pushbutton valves, metering non-hold open type with 1/2 GPM flow control. Valves shall require less than 5 lbs. push to activate. Cabinet bottom shall be enclosed and have no accessible voids or crevices where contraband can be concealed. Cabinet interior is sound-deadened with fire-resistant material. Fixture shall be furnished with necessary fasteners for proper installation, off-floor wall outlet, lavatory extension with P-trap and cleanout, and penal bubbler.

D. SDF-1 Drinking Fountains: Provide Acorn or equivalent Penal-Ware Handicapped Drinking Fountain - Front Access Model Number 1672. Fixture shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Cabinet interior is sound-deadened with fire-resistant material. Fixture shall be furnished complete with an Air-Trol self closing valve, a penal bubbler, lavatory extension with P-trap and cleanout, and necessary fasteners for proper installation. Where two are indicated, mount one at barrier free height and one at standard height.

1. Remote Chiller for Drinking Fountains: Provide Elkay Model ER-10 or equivalent remote water cooler with heavy steel cabinet, 1/4 HP 115/1/60 hermetically sealed compressor, and wall mounting bracket. Capacity 9.6 gph of 50 F water, 80 F inlet and 90 F ambient.

E. SSH-1 Showers: Provide Acorn or equivalent Recessed Mounted Penal-Pak Handicapped Wall Shower Model Number 1741, modified. Shower panel shall be fabricated from 14 gage, type 304 stainless steel and shall have a satin finish. Exposed trim shall be chrome-plated brass. Panel shall have security fasteners. Fixture shall be furnished with fixed shower head, a flex-shower with a stainless steel, positive shut-off quick-disconnect and mounting bracket. Fixture shall be provided with necessary fasteners for proper installation. Refer to P-8A for valving.

F. SVB-1 Remote Shower Valve/Diverter Valve Wall Box: Provide Acorn or equivalent recessed stainless steel remote dual supply valve box for shower control, Model 8210, modified. Supply box shall be fabricated from 18 gage type 304 stainless steel with satin finish 16 gage wall frame and lockable door. Provide cold and tempered water cartridge-operated type control valves with individual screwdriver operated stop, temperature gage, and diverter valve. Diverted valve shall be tagged "Upper" and "Lower", and shall supply water to upper showerhead or lower barrier-free flex-showerhead. Refer to P-8.
G. SVB-2 Shut-Off Valve Wall Box: Provide 20"W x 24"H recessed steel cabinet with white baked enamel finish, hinged locking door with three sets of keys, and top outlet and inlet connections.

2.22 FAUCETS

A. F-1 Lavatory Faucet: Sensor operated plug-in powered chrome plate cast brass faucet with infrared sensor, solenoid valve, inline filter, and 0.5 gpm vandal-resistant outlet. Zurn Model Z6915-XL-ACA-F.

B. F-1 Lavatory Faucet: Polished chrome plated all metal deck mounted faucet, 4" center set, spout with 0.35 gpm vandal resistant chrome plated constant flow outlet, single lever metal handle. Chicago Faucet Model 420-E39VPABCP or equivalent.

C. F-2 Sink Faucet: Polished chrome plated deck mount, 8" center set, gooseneck spout with 1.0 gpm chrome plated constant flow outlet, and wrist blade handles. Chicago Faucet Model 1100-GN2E28-317CP or equivalent.

D. F-7 Sink Faucet: Polished chrome plated all metal deck mounted faucet, 8" center set, 9" swivel spout with 2.2 gpm chrome plated constant flow outlet, and single lever metal handle, less handspray, American Standard Model 4205.000 or equivalent.

E. F-4 Lavatory Faucet: Polished chrome plated all metal deck mounted faucet, 4" center set, spout with 2.2 gpm chrome plated constant flow outlet, less pop up drain and hole, single lever metal handle. American Standard Model 2385.404 or equivalent.

F. F-5 Lavatory Faucet: Polished chrome plated all metal deck mounted faucet, 4" center set, spout with 0.5 gpm vandal resistant chrome plated constant flow outlet, less pop up drain and hole, single lever metal handle. American Standard Model 7385.050 or equivalent.

G. F-1 Lavatory Faucet: Sensor operated high spout brass faucet with a polished chrome exterior, 0.5 gpm vandal resistant outlet, single tempered water service, above deck sealed electronics module, solenoid valve, supply hose with filter screens, mounting hardware, and plug-in transformer. Sloan Model EAF-100 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

H.

I.

J. F-3 Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid valve body, rigid gooseneck spout with 1.5 gpm aerator outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786-E35ABCP[ or equivalent].

K. F-3 Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid valve body, rigid gooseneck spout with 2.2 gpm laminar flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786-E29CP[ or equivalent].
L. F-1 Lavatory Faucet: Polished chrome plated cast brass, 4" center set, rigid gooseneck spout with 2.2 gpm laminar flow outlet, and 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 895-317E29CP [or equivalent].

M. F-1 Lavatory Faucet: Polished chrome plated all metal deck mounted metering faucet, 4" center set, spout with 0.5 gpm vandal resistant chrome plated constant flow outlet, less pop up drain and hole, push down handles. Chicago Faucet Model 802-V665CP [or equivalent].

N. F-1 Lavatory Faucet: Polished chrome plated all metal deck mounted metering faucet, 4" center set, spout with 0.5 gpm vandal resistant chrome plated constant flow outlet, less pop up drain and hole, push down handles. Chicago Faucet Model 802-VE2805-665ABCP [or equivalent].

O. F-6 Service Faucet: Rough chrome plated cast brass, combination service sink fitting with vacuum breaker, 3/4" threaded hose spout, metal lever handles indexed "HOT" and "COLD" plus red and blue index tabs, wall brace, pail hook, adjustable flanged female supply arms and having integral stops. Chicago Faucet Model 897-RCF or equivalent.

P. F-7 Sink Faucet: Polished chrome plated cast brass deck mount faucet with 8" center set, swivel high arch 9" spout, 1.5 gpm outlet, and hand spray. American Standard Model 4101.301.F15 or equivalent.

Q. F-2 Service Faucet: Rough chrome plated cast brass, service sink fitting for ceiling supplies, with vacuum breaker, 3/4" threaded hose spout, metal lever handles indexed "HOT" and "COLD" plus red and blue index tabs, wall brace, pail hook, and body support plate. Chicago Faucet Model 835-RCF or equivalent.

R. F-3 Classroom Sink Faucet and Bubbler: Polished chrome plated cast brass deck mounted quarter turn rigid body faucet with 8" center set, rigid gooseneck spout with 1.5 gpm outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786 E35ABCP or equivalent. Polished chrome plated vandal resistant self-closing, push button bubbler with built-in 0.7 gpm volume control, and anti-microbial flexible projector head. Chicago Faucet Model 748-665FHABCP or equivalent.

S. F-3 Classroom Sink Faucet and Bubbler: Polished chrome plated cast brass deck mounted quarter turn faucet with 8" center set, rigid gooseneck spout with 0.5 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786 E3CP or equivalent. Polished chrome plated vandal resistant self-closing, push button bubbler with built-in 0.7 gpm volume control, and anti-microbial flexible projector head. Chicago Faucet Model 748-665FHABCP or equivalent.

T. F-3 Classroom Sink Faucet and Bubbler: Polished chrome plated cast brass deck mounted quarter turn faucet with 8" center set, rigid gooseneck spout with 0.5 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786 E35VPJKCP or equivalent. Polished chrome plated self-closing, push button bubbler with built-in 0.7 gpm volume control, and anti-microbial flexible projector head. Chicago Faucet Model 748-665FHABCP or equivalent.

U. F-3 Sink Faucet: Polished chrome plated deck mount, 8" center set, 8" swing spout with 2.2 gpm chrome plated constant flow outlet, and single lever handle. Elkay Model LK-4100 or equivalent.
V. F-3 Sink Faucet: Polished chrome plated deck mount, 8" center set, 8" swing spout with 2.2 gpm chrome plated constant flow outlet, and single lever handle. Chicago Faucet Model 2300-8CP or equivalent.

W. F-3 Sink Faucet: Polished chrome plated deck mount, 8" center set, 8" swing spout with 0.5 gpm chrome plated constant flow outlet, and single lever handle. Chicago Faucet Model 2300-8CP with E2805JKCP outlet or equivalent.

X. F-3 Sink Faucet: Polished chrome plated deck mount, 8" center set, swing spout with 2.2 gpm chrome plated constant flow outlet, and lever handles. Chicago Faucet Model 1888 or equivalent.

Y. F-3 Sink Faucet: Polished chrome plated deck mount, 8" center set, swing spout with 0.5 gpm chrome plated constant flow outlet, and lever handles. Chicago Faucet Model 1888 with E2805-5JKCP outlet or equivalent.

Z. F-5 Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid gooseneck spout with 2.2 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786-E3CP or equivalent.

AA. F-5 Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid gooseneck spout 0.5 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786 E35VPJKCP or equivalent.

BB. F-6 Kitchen Hand Wash Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid gooseneck spout with 2.2 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786-E3CP or equivalent.

CC. F-6 Kitchen Hand Wash Sink Faucet: Polished chrome plated cast brass deck mount quarter turn faucet with 8" center set, rigid gooseneck spout with 0.5 gpm constant flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786 E35VPJKCP or equivalent.

DD. F-7 Utility Sink Faucet: Polished chrome plated cast brass, 4" center set, rigid gooseneck spout with 2.2 gpm constant flow outlet. Chicago Faucet Model 895-CP or equivalent.

EE. F-7 Utility Sink Faucet: Polished chrome plated cast brass, 4" center set, rigid gooseneck spout with 0.5 gpm constant flow outlet. Chicago Faucet Model 895- E35VPJKCP or equivalent.

FF. F-8 Clinic Service Sink Faucet: Chrome plated cast brass sink faucet with 6" elbow blades, rigid vacuum breaker spout with 3/4" hose thread outlet, pail hook, bottom wall brace and 1/2" flanged female adjustable integral stop arms. Chicago Faucet Model 814 VB or equivalent.

GG. F-9 Tub and Shower Valve: Thermostatic mixer type shower and tub valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate, stainless steel seats, stainless steel wearing surfaces on the inner valve, adjustable safety limit stop and check stop. Provide complete with chrome plated brass diverter tube spout, shower arm with escutcheon and adjustable volume control shower head. Powers Model L426 or equivalent.
HH. F-10  Sink Faucet: Polished chrome plated cast brass, 8" center set, swing spout with constant flow aerator, 2" blade handles, and adjustable arms with integral stops. Chicago Faucet Model 445 with R supply arms, or equivalent.

II. F-11  Lavatory Faucet: Polished chrome plated cast brass, 4" center set, rigid gooseneck spout with 1.6 gpm chrome plated laminar flow outlet, 4" wrist blade handles. Chicago Faucet Model 895-317FCCP or equivalent.

JJ. F-12  Sink Faucet: Polished chrome plated cast brass, 8" center set, swing gooseneck spout with 2.2 gpm chrome plated laminar flow outlet and 4" wrist blade handles. Chicago Faucet Model 786-E29CP or equivalent.

KK. F-13  Lavatory and Sink Faucet: Sensor operated battery operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 2.2 gpm vandal-resistant laminar flow outlet. [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-C-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

LL. F-13  Lavatory and Sink Faucet: Sensor operated plug-in operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 2.2 gpm vandal-resistant laminar flow outlet. [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-ACA-C-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

MM. F-13  Lavatory and Sink Faucet: Sensor operated hardwire operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 2.2 gpm vandal-resistant laminar flow outlet. [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-CWB-C-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

NN. F-13A  Lavatory and Sink Faucet: Sensor operated battery operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 0.5 gpm vandal-resistant outlet, [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-F-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

OO. F-13A  Lavatory and Sink Faucet: Sensor operated plug-in operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 0.5 gpm vandal-resistant outlet, [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-ACA-F-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

PP. F-13A  Lavatory and Sink Faucet: Sensor operated hardwire operated [3-1/2"][8"] gooseneck brass faucet with a polished chrome exterior, solenoid valve, infrared sensor, inline filter, 0.5 gpm vandal-resistant outlet, [4"][8"] cover plate, ]and ASSE 1016 thermostatic mixing valve. Zurn Model Z-6920-CWB-F-[CP4][CP8]-[GA][GC]-TMV-1 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

QQ. F-13B  Lavatory Faucet: Sensor operated battery operated chrome plate cast brass faucet with infrared sensor, solenoid valve, inline filter, 0.5 gpm vandal-resistant outlet, and ASSE 1016 thermostatic mixing valve. Zurn Model Z6915-F-TMV-1 or equivalent.
RR. F-13B  Lavatory Faucet: Sensor operated plug-in powered chrome plate cast brass faucet with infrared sensor, solenoid valve, inline filter, 0.5 gpm vandal-resistant outlet, and ASSE 1016 thermostatic mixing valve. Zurn Model Z6915-ACA-F-TMV-1 or equivalent.

SS. F-13B  Lavatory Faucet: Sensor operated hardwire powered chrome plate cast brass faucet with infrared sensor, solenoid valve, inline filter, 0.5 gpm vandal-resistant outlet, and ASSE 1016 thermostatic mixing valve. Zurn Model Z6915-CWB-F-TMV-1 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

TT. F-14  Scrub Sink Faucet: Wall-mounted knee-controlled hot and cold water mixing valve, with wall bracket and escutcheons, renewable seat, screwdriver stops, and spray outlet gooseneck spout. American Standard Model 7676.029 and 7522.055 or equivalent.

UU. F-15  Tub and Shower Valve: ASSE 1016 pressure balance mixer type shower and tub valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate, with ceramic disc valving, adjustable safety limit stop, and screw driver stops. Provide complete with chrome plated brass diverter tube spout, shower arm with escutcheon, and maximum 1.75 gpm shower head. Zurn Z7302-SS-MT with Z7000-S8 or equivalent.

VV. F-15A  Tub and Shower Valve Assembly (Barrier-Free): ASSE 1016 balanced pressure mixer type shower and tub valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate with ceramic disc valving, adjustable safety limit stop and check stops. Provide complete with chrome plated brass diverter tube spout, shower arm with escutcheon, maximum 1.75 gpm shower head, chrome plated brass diverter valve, hand held shower head with slide bar and hose. Zurn Z7302-SS-MT DV2P-HW with Z7000-S8 or equivalent.

WW. F-16  Sink Faucet: Polished chrome plated cast brass, 8" center set, 9" swing spout with constant flow aerator, 2" blade handles, and adjustable supply arms. Chicago Faucet Model 540-LDL9 or equivalent.

XX. F-2  Lavatory Faucet: Sensor battery operated high spout brass faucet with a polished chrome exterior, 0.5 gpm vandal-resistant outlet, single tempered water service, above deck sealed electronics module and solenoid valve with filter screen, inlet supply checks, flexible stainless steel supply hoses with filter screens, and mounting hardware. Include handheld PDA with software for tool-free adjustment of faucet settings and to perform diagnostics and field maintenance. Chicago Faucet Model 116.202.AB.1 or equivalent.

YY. F-7  Sink Faucet: Chrome plated single handle deck mount kitchen faucet. Center mount with 16" high by 10" long spout that swings 360 degrees, lever handle, ceramic disc cartridge, 1.5 gpm pull-down spray head wand operates in aerated or spray mode, red and blue graphics on handle button to indicate hot/cold temperature, magnetic docking system secures sprayer to spout, integral double check valves in sprayer assembly, integrated removable debris screen in sprayer assembly, and 3/8" O.D. supply tubes. Delta Model 989-DST or equivalent.

ZZ. F-4  Tub and Shower Valve: Chrome plated ASSE 1016 pressure balance mixer type shower and tub valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from...
outside the wall through valve cover plate, with ceramic disc cartridge, adjustable safety limit stop and check stop. Provide complete with chrome plated brass diverter tube spout, shower arm with escutcheon and adjustable 1.5 gpm shower head. American Standard "Colony Soft" Model T675.508 trim kit and R120SS valve body or equivalent.

AAA. F-5 Shower Valve: Chrome plated ASSE 1016 pressure balance mixer type shower valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate, stainless steel seats, with ceramic disc cartridge, adjustable safety limit stop and check stop. Provide complete with chrome plated shower arm with escutcheon and adjustable 1.5 gpm shower head. American Standard "Colony Soft" Model T675.507 trim kit and R120SS valve body or equivalent.

BBB. F-6 Shower Valve Assembly (Barrier-Free): Chrome plated ASSE 1016 pressure balance mixer type shower valve with single metal blade handle. Valve shall open to cold water first and then through warm (mix) to hot. Valve shall have operating parts separately replaceable from outside the wall through valve cover plate with ceramic disc cartridge, adjustable safety limit stop and check stops. Provide complete with chrome plated shower arm with escutcheon, 1.50 gpm hand held shower head with 36" slide bar and 60" flexible hose. American Standard "Colony Soft" Model 1662.211 or equivalent.

CCC. F-4 Sink Faucet: Polished chrome plated cast brass rigid valve body deck mount quarter turn faucet with 8" center set 8" C-C gooseneck spout with 1.5 gpm outlet, 4" wrist blade handles indexed "HOT" and "COLD". Chicago Faucet Model 786-GN8AE35ABCP or equivalent.

DDD. F-2 Lavatory Faucet with Eye-Wash: Polished chrome plated deck mount quarter turn faucet with gooseneck spout with 2.2 gpm laminar flow outlet, 4" wrist blade handles indexed "HOT" and "COLD". Include 2.9 gpm pull handle eye-wash with two non-aerated yellow plastic spray outlets with dust covers and ANSI Z358.1 compliant eyewash thermostatic mixing valve. Speakman Model SEF-1800-CA-LF-NA-TW.

2.23 FLUSH VALVES

A. FV-1 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.6 gallon water closets, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2" top spud connection. Include sensor/solenoid connector wire. Provide one 120volt/6 vdc hardware power converter for each floor. Zurn Model ZEMS 6000PL-IS-WS1.

B. FV-1 Flush Valve: Exposed, chrome plated, battery-powered sensor operated flush valve for 1.28 gallon water closets; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass;1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2" top spud connection. Sloan Model 8111 or equivalent.

C. FV-1 Flush Valve: Dual-flush quiet, exposed, chrome plated, diaphragm operated flush valve for 1.6 gallon water closets, with non-hold-open low force/ADA compliant handle; chloramine
resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; spud coupling and flange for 1-1/2" top spud connection, and graphical wall plate with instructions. Zurn Model Z6000AV-DF-WS1 or equivalent.

D. FV-1 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve for 1.6 gallon water closets, with non-hold-open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Zurn Model Z6000AV-WS1 or equivalent.

E. FV-2 Flush Valve: Exposed, chrome plated, battery-powered sensor operated flush valve for 0.5 gallon urinals; automatic sensor; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 3/4" top spud connection. Sloan Model 8186 or equivalent.

F. FV-2 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated 1.0 gallon urinal flush valve, with non-hold open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 3/4" I.P.S. screw driver angle stop with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange; vacuum breaker; and spud coupling and flange for 34" top spud connection. Zurn Model Z6003AV-WS1 or equivalent.

G. FV-1 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve for 1.6 gallon water closets, with non-hold-open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Sloan Model 111-DFB.

1. Where indicated, provide Zum Model 6000-TPO or equivalent exposed trap primer flush tube assembly.

H. FV-3 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve for 6.5 gpm [clinic service sink], with non-hold-open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Zurn Model Z6017 or equivalent.

I. FV-2 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve for 6.5 gpm [clinic service sink], with non-hold-open handle; chloramine resistant, dual seal diaphragm with a clog resistant dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Sloan Model 117DFB.
J. FV-5 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve with off-set flush tube for 1.6 gallon water closets, with non-hold-open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; tilt down bedpan washer with diverter valve and wall bracket; and spud coupling and flange for 1-1/2” top spud connection. Zurn Model Z6011AV-BW-WS1 or equivalent.

K. FV-6 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.6 gallon water closets, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2” top spud connection. Include sensor/solenoid connector wire. Provide one 120volt/6 vdc hardwire power converter for each toilet room. Zurn Model ZEMS 6000AV-WS1 or equivalent.

L. FV-7 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.0 gallon urinals, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/4” top spud connection. Include sensor/solenoid connector wire. Provide one 120volt/6 vdc hardwire power converter for each toilet room. Zurn Model ZEMS 6001AV-WS1 or equivalent.

M. FV-7 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.0 gallon urinals, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 3/4” top spud connection. Include sensor/solenoid connector wire. Provide one 120volt/6 vdc hardwire power converter for each toilet room. Zurn Model ZEMS 6003AV-WS1 or equivalent.

N. FV-1 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.6 gallon water closets, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2” top spud connection. Include sensor/solenoid connector wire. Zurn Model ZEMS 6000AV-WS1 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

2. Provide Zurn Model P6000-TPO trap primer assembly on one water closet flush valve per toilet room

O. FV-2 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.0 gallon urinals, with 6 v DC valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1” I.P.S. screw driver operated combination angle back check and stop valve with
protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/4" top spud connection. Include sensor/solenoid connector wire. Zurn Model ZEMS 6001AV-WS1 or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

P. FV-3 Flush Valve: Quiet, concealed, rough brass, diaphragm operated flush valve for 1.6 gallon water closets, with non-hold-open 1" push button; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. combination angle check and stop valve; sweat solder kit; adjustable tailpiece; vacuum breaker; and spud coupling for 1-1/2" back spud connection. Zurn Model Z6143AV-WS1-L or equivalent.

Q. FV-1 Flush Valve: Exposed, chrome plated, battery powered sensor operated flush valve for 1.6 gallon water closets, with automatic sensor with manual push button override; 1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2" top spud connection. Zurn Model ZER6000-WS1 or equivalent.

R. FV-2 Flush Valve: Exposed, chrome plated, battery powered sensor operated flush valve for 1.0 gallon urinals, with automatic sensor with manual push button override; 3/4" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 3/4" top spud connection. Zurn Model ZER6003-WS1 or equivalent.

S. FV-5 Flush Valve: Quiet, concealed, rough brass, diaphragm operated flush valve for 3.5 gallon flushing rim floor sink, with non-hold-open push button; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; angle check and stop valve; sweat solder kit; tailpiece; and vacuum breaker. Zurn Model Z6150AV or equivalent.

T. FV-5 Flush Valve: Quiet, concealed, rough brass, diaphragm operated flush valve for 3.5 gallon flushing rim floor sink, with 24VAC solenoid activation device; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; angle check and stop valve; sweat solder kit; tailpiece; and vacuum breaker. Zurn Model Z6150AV or equivalent.

U. FV-1 Flush Valve: Quiet, exposed, chrome plated, battery powered sensor operated flush valve for 1.6 gallon water closets, automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Sloan Optima Model 811.

V. FV-2 Flush Valve: Dual-flush (1.6/1.1 gpf) quiet, exposed, chrome plated, battery powered sensor operated flush valve for 1.6 gallon water closets, automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Sloan Ecos Model 8111-1.6/1.1.
W. FV-3 Flush Valve: Quiet, exposed, chrome plated, battery powered sensor operated flush valve for 0.5 gallon urinals, with automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant dual filtered by-pass; 3/4" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 3/4" top spud connection. Sloan Model 8186.

X. FV-1 Flush Valve: Chrome plated, self-generating hydro-powered piston type sensor operated flush valve for 1.28 gallon water closets, with manual override button; 1" combination angle check and stop valve with vandal resistant cap; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Toto Model TET1LN32CP [or equivalent].

Y. FV-2 Flush Valve: Chrome plated, self-generating hydro-powered piston type sensor operated flush valve for 0.5 gallon urinals, with manual override button; 3/4" combination angle check and stop valve with vandal resistant cap; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 3/4" top spud connection. Toto Model TEU1LN12CP [or equivalent].

Z. FV-1 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 1.28 gallon water closets, with 24v valve actuator; automatic sensor with manual push button override; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass;1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 1-1/2" top spud connection. Sloan Model 111-1.28 ES-S TMO or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

AA. FV-2 Flush Valve: Exposed, chrome plated, hard wired sensor operated flush valve for 0.125 gallon urinals, with 24v valve actuator; automatic; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass;1" I.P.S. screw driver operated combination angle back check and stop valve with protective vandal resistant cap; adjustable tailpiece; vacuum breaker flush connection; sweat solder kit; cast wall flange with set screw; and spud coupling and flange for 3/4" top spud connection. Sloan Model 186 ES-S or equivalent.

1. Refer to sensor faucet and flush valve accessories article below for transformers and mini-junction boxes.

2.24 SENSOR FAUCET AND FLUSH VALVE ACCESSORIES

DESIGNER NOTE: Confirm with the University prior to using hard-wired flush valves or sensor faucets. Typical sensor flush valves shall be battery powered, and typical lavatory faucets shall be manual.

A. Provide flush valves hardwired power converters, mini junction boxes, and required low voltage wiring for power connection to sensor operated flush valves.

1. Include separate system for each toilet room.
B. Provide faucet plug-in power converters and required low voltage wiring for power connection to sensor operated faucets.

1. Include separate system for each toilet room.

C. Provide <insert quantity (XX) >Zurn P6000-HW6 or equivalent hardwired power converters and <insert quantity (XX) >Zurn P6000-MJ or equivalent mini junction boxes for power connection to sensor operated faucets and flush valves.

2.25 TOILET SEATS

A. TS-1    Elongated, heavy duty, solid white plastic toilet seats with molded-in bumpers, closed back/open front, less cover, and having stainless steel check hinge and stainless steel nuts. Centoco Model 500STSCC or equivalent.

B. TS-1    Elongated, heavy duty, solid white plastic toilet seats with molded-in bumpers, closed back/open front, less cover, and having stainless steel check hinge. Olsonite Model 10CT or equivalent.

C. TS-2    Elongated, heavy duty, solid white plastic toilet seats with molded-in bumpers to provide 2" lift, closed back/open front, less cover, and having stainless steel check hinge. Olsonite Model 210CC or equivalent.

D. TS-3    Round, heavy duty, solid white plastic toilet seats with molded-in bumpers, closed back/open front, less cover, and having stainless steel check hinge. Olsonite Model 126CC or equivalent.

E. TS-4    Elongated, solid white plastic toilet seats with molded-in bumpers, closed front, cover, and having stainless steel hardware package. Olsonite Model 94SS or equivalent.

F. TS-1    Elongated, solid white plastic toilet seats, closed front with cover, with stainless steel mounting bolts. Kohler Model K-4650 or equivalent.

G. TS-2    Elongated, heavy duty, solid white plastic toilet seats, closed back/open front, less cover, with check hinge and stainless steel mounting bolts. Kohler Model K-4666C or equivalent.

2.26 FIXTURE SUPPORTS

A. General: All Fixture support carriers to conform to ANSI A112.6.1M (American National Standards Institute).

B. [Urinal and Water Cooler Support Carriers]: Wade W-400-AM11-M36 or equivalent foot supported carrier with rectangular structural steel uprights, top support plate, and lower bearing plate with studs.

C. Urinal and Water Cooler Support Carriers: Wade W-400-AM11-M36 or equivalent foot supported carrier with rectangular structural steel uprights, top support plate, and lower bearing plate with studs.
D. Kitchen Hand Wash Sink Support Carriers: Wade W-510LK-M36 or equivalent foot supported carrier with rectangular structural steel uprights and mounting studs.

E. Water Closet Support Carriers: Wade W-300 series or equivalent foot supported carrier with vertical or horizontal waste fitting configuration as required by waste piping installation. Single closet carriers shall be provided with rear anchoring foot. Closet coupling and fixture support rods shall be of proper length for wall thickness. M4 rod support feet shall be furnished when span from inside of finish block wall to face of carrier faceplate exceeds 6”. M4 rod support feet shall also be provided on each water closet carrier installed on stud type wall construction.

F. Water Closet Support Carriers: Wade W-300 series or equivalent heavy duty (500 pound capacity) foot supported carrier with vertical or horizontal waste fitting configuration as required by waste piping installation. Carrier shall be securely bolted to floor construction and single closet carriers shall be provided with rear anchoring foot also securely bolted to floor construction. Closet coupling and fixture support rods shall be of proper length for wall thickness. M4 rod support feet shall be furnished and securely bolted to floor construction when span from inside of finish block wall to face of carrier faceplate exceeds 6”. M4 rod support feet shall also be provided on each water closet carrier installed on stud type wall construction.

G. Water Closet Support Carriers: Wade W-300 series or equivalent foot supported carrier with vertical or horizontal waste fitting configuration as required by waste piping installation. Single closet carriers shall be provided with rear anchoring foot. Closet coupling and fixture support rods shall be of proper length for wall thickness.

1. Include M14 cast iron yoke option for floor mounted back outlet fixtures.

H. Lavatory Support Carriers: "Wade" Model W-520-M36 Series or equivalent concealed arm, foot supported carrier with rectangular structural steel uprights.

I. Clinic Service Sink Carriers: "Wade" Model W-640 Series or equivalent foot supported carrier with vertical or horizontal waste fitting configuration as required by waste piping installation. Closet coupling and fixture support rods shall be of proper length for wall thickness.

2.27 UNDER-LAVATORY GUARDS

DESIGNER NOTE: Coordinate if Under-Lav guards will be needed or if knee-boards or similar will be provided by Architects.

A. Under-lavatory Shield-Type Guard:

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

   a. Truebro by IPS Corporation; Lav-Shield.

2. Description: One piece shield for covering supply and drain piping assemblies and other underlav mounted accessories to prevent direct contact with and to provide vandal resistance. Field trim to fit tightly to lavatory and adjacent surfaces.

3. Material and Finish: Rigid, high impact, stain resistant, molded PVC plastic, white.
B. Under-Lavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Plumberex Specialty Products, Inc.
   b. Truebro by IPS Corporation.
   c. ProFlo

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.


2.28 FITTINGS, TRIM AND ACCESSORIES

A. Fittings for Plumbing Fixtures: Fittings include the following:

1. Supply Inlets: Copper tube, size required for final connection.
2. Supply Stops: Chrome-plated brass body, angle or straight configuration with compression fittings, loose-key type; size to match inlet pipe and supply riser.
3. Supply Risers: 3/8-inch OD flexible chrome-plated brass tube with 1/2-inch IPS straight or offset, knob-end tailpiece; or braided flexible stainless steel.
4. Traps: Chrome-plated, 17 gauge tubular brass P-trap and wall bend, with slip-joint inlet, wall flange, and escutcheon; same size as fixture outlet connection.
   a. For concealed applications within water coolers or casework, ASTM F 409 PVC one or two-piece trap and waste to wall maybe used.
   b. Refer to Section 22 1319 “Sanitary Waste Piping Specialties” for p-trap type trap primers below lavatories and sinks where indicated.
   c. Refer to Section 22 1119 “Domestic Water Piping Specialties” for p-trap type trap primers below wall mounted lavatories where indicated.

B. Refer to Section 05 5000 “Metal Fabrications” for stainless steel shields below wall mounted lavatories.

C. Refer to Section 10 2800 “Toilet, Bath, and Laundry Accessories” for plastic shields below wall mounted lavatories.

D. Refer to Section 10 2800 “Toilet, Bath, and Laundry Accessories” for below wall mounted lavatory barrier-free lavatory and sink trap and supply insulation kits.
   1. Not required at barrier-free sinks mounted in casework with kneeboard.

E. Barrier-Free Lavatory Trap Shield: Provide Truebro or equivalent Lav Shield, constructed of high impact stain resistant molded plastic, white in color, complete with wall anchors.

F. Barrier-Free Lavatory and Sink Insulation Kits: Provide complete kits comprised of molded, flexible insulation pieces, white in color and suitable for covering tailpiece, P-trap, two riser tubes, and two angle stop valves; complete with nylon strap-type fasteners. Equal to TRUEBRO Inc., Handi Lav-Guard insulation kit, or Brocar Trap Wrap.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting 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 back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. 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 valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
L. Install toilet seats on water closets.

M. Install trap-seal liquid in dry urinals.

N. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

O. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

P. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install \(\text{in sink deck} [\text{on countertop at sink}] <\text{Insert location}>\). Connect inlet hose to dishwasher and outlet hose to disposer.

Q. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

S. Set mop basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

T. Set \([\text{bathtubs}] [\text{shower receptors}] [\text{and}] [\text{service basins}]\) in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

V. Seal juncture between security type plumbing fixtures and building with mildew resistant security type caulk. Refer to Division 07.

W. Install hardwired sensor operated flush valves in accordance with manufacturer's instructions. Coordinate with Division 26.
   1. Coordinate water rough-in dimension, flush tube length, and grab bar mounting height to provide proper clearances.

X. Install sensor flush valves in accordance with manufacturer’s instructions. Adjust settings and verify proper operation.
   1. Coordinate water rough-in dimension, flush tube length, and grab bar mounting height to provide proper clearances.

Y. Install flushing rim floor drain flush valves in accordance with manufacturer’s instructions. Install flush valve in chase and route water line underfloor to flushing rim floor drain. Adjust settings and verify proper operation.
1. Locate manual push button in <Insert Location Here>
2. Electronic activation shall be by <Insert How Here>

Z. Install flush valves in accordance with manufacturer’s instructions. Adjust settings and verify proper operation.

1. Install flush valves on barrier-free units with handles on wide side of stall.

AA. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

BB. Install emergency eye wash/showers in accordance with manufacturer’s instructions. Adjust settings and verify proper operation.

CC. Install eye washes in accordance with manufacturer’s instructions. Adjust settings and verify proper operation.

DD. Install flush valves in accordance with manufacturer’s instructions. Install batteries in sensor operated flush valves. Adjust settings and verify proper operation.

EE. Install sensor operated faucets in accordance with manufacturer’s instructions. Coordinate with Division 26.

FF. Install instructional wall plate at “dual flush” flush valves in accordance with manufacturer’s instructions.

GG. Install under-lavatory insulation kits at [barrier-free][all] lavatory and sink locations in accordance with the following:

1. Cover hot- and cold-water supply risers, stops and handles, tailpiece, trap, and wall bend. Install in accordance with manufacturer’s installation instructions. Trim connectors flush so no sharp edges remain.

HH. Install under-lavatory protective shield at[barrier-free][all] wall mounted lavatory locations in accordance with manufacturer's installation instructions.

II. Install fresh batteries in sensor-operated mechanisms.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust [disposers] [hot-water dispensers] [and] [controls]. Replace damaged and malfunctioning units[ and controls].

C. Adjust water pressure at [faucets] [and] [flushometer valves] to produce proper flow and stream.

D. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flush valves having controls, to produce proper flow and stream.

E. Adjust shower valve maximum temperature limit stop in accordance with manufacturers’ recommendations and in compliance with the plumbing code and authority having jurisdiction.

F. Adjust mixing valve maximum temperature limit stop in accordance with manufacturers’ recommendations and in compliance with the plumbing code and authority having jurisdiction.

G. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers’ recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the following:

1. Faucets.
2. Flush valves.
3. Water coolers
4. Drinking fountains
5. Shower valves.
7. Emergency shower and eye washes.
8. Waterless urinals.

B. Refer to Division 01 Section "Demonstration and Training."

3.9 FIXTURE HEIGHT SCHEDULE

A. Install fixtures to heights above finished floor as indicated.

1. Water Closet:
   a. Standard: 15 inches to top of bowl rim.
   b. Barrier Free: 18 inches, top of seat.
   c. Barrier Free: 17 to 19 inches, top of seat.

2. Water Closet Flush Valves:
   a. Standard: 10 inches min. above bowl rim.

3. Urinal:
   a. Standard: 22 inches to top of bowl rim.
   b. Barrier Free: 17 inches maximum to top of bowl rim.

4. Urinal Flush Valves:
   a. Standard: 11 inches min. above top.
   b. Barrier Free: 46 inches maximum to flush valve handle.

5. Lavatory:
a. Standard: 34 inches to top of basin rim.
b. Standard: 31 inches to top of basin rim.
c. Barrier Free: 34 inches to top of basin rim.

6. Water Cooler:
   a. Standard Adult: Minimum 38 inches and maximum 43 inches to spout outlet.
   b. Barrier Free: Maximum 36 inches to spout outlet.

7. Drinking Fountain:
   a. Standard Adult: 40 inches to top of basin rim.
   b. Barrier Free: Maximum 36 inches to top of spout.

8. Individual Shower Heads:
   a. Adult Male: 72 inches to bottom of head.
   b. Adult Female: 68 inches to bottom of head.

9. Gang Shower Heads:
   a. Adult Male: 69.5 inches to bottom of head.
   b. Adult Female: 64.5 inches to bottom of head.

10. Barrier Free Shower Controls:
    a. Minimum 38 inches above floor.
    b. Maximum 48 inches above floor.

11. Barrier Free Shower Spray Unit Slide Bar:
    a. Bottom minimum 41 inches above floor.
    b. Top minimum 72 inches above floor.

12. Emergency Eye and Face Wash:
    a. Standard: 38 inches to receptor rim.

13. Emergency Shower:
    a. Standard: 84 inches to bottom of head.

3.10 FIXTURE ROUGH-IN SCHEDULE

A. Line sizes indicated below are run-out sizes, reduce size as required at connection to fixture. Main lines and drops shall be installed in sizes as indicated on drawings.

1. Water Closet (Flush Valve Type):
   a. Cold Water: 1 Inch.
   c. Vent: 2 Inch.

2. Water Closet (Tank Type):
   c. Vent: 2 Inch.
3. Bidet:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.

4. Urinal (Flush Valve Type):
   a. Cold Water: 1 Inch.
   b. Waste: 2 Inch.
   c. Vent: 1-1/2 Inch.

5. Urinal (Waterless Type):
   a. Waste: 2 Inch.

6. Lavatory:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.

7. Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 2 Inch.
   d. Vent: 1-1/2 Inch.

8. Service Sink:
   c. Waste: 3 Inch.
   d. Vent: 1-1/2 Inch.

9. Water Cooler:

10. Drinking Fountain:

11. Bathtub:
    a. Hot Water: 1/2 Inch.
    b. Cold Water: 1/2 Inch.
    c. Waste: 2 Inch
    d. Vent: 1-1/2 Inch.
12. Hydrotub:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 2 Inch
   d. Vent: 1-1/2 Inch.

13. Shower:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 2, 3, or 4 Inch.

14. Clinical Sink:
   b. Faucet Hot Water: 1/2 Inch.
   c. Faucet Cold Water: 1/2 Inch.
   d. Waste: 4 inch.
   e. Vent: 2 inch.

15. Emergency Shower/Eye Wash:

16. Emergency Eye Wash:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.

17. Emergency Shower:
   a. Cold Water: 1 inch.

18. Utility Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 2 inch

19. Mop Basin:
   c. Waste: 3 inch.
   d. Vent: 1-1/2 inch.

20. Scrub Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 1-1/2 inch

END OF SECTION 22 4000