

SECTION 15100 - BUILDING SERVICES PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Reverse osmosis water system piping.
3. Sanitary waste and vent piping.
4. Air conditioning condensate piping.
5. Waste cooking oil piping.
6. Water piping and drain piping specialties.
7. Grease interceptors.
8. Pumps including sump pumps, liquid transfer pump stations, & domestic water booster pumps.
9. Connection of miscellaneous equipment furnished under other Sections.

B. Related Requirements:

1. Appendix A – Products and Work By Owner or Separate Contractor.
 - a. General procedures related to Owner furnished products and transport, handle, store and protect products.(Formerly included in Section 01640).
2. Section 06100 - Rough Carpentry: Preservative pressure treatment for wood blocking pipe supports.
3. Section 07530 – Elastomeric Membrane Roofing.
4. Section 07620 - Sheet Metal Flashing and Trim: Flashing of roof penetration.
5. Section 11140 - Vehicle Service Equipment: Automotive Center piping.
6. Section 15050 - Basic Mechanical Materials and Methods: Piping hangers and supports.
7. Section 15480 - Domestic Water Heaters: Recirculating pumps for domestic water heating system.
8. Appendix A – Products and Work By Owner or Separate Contractor
 - a. General procedures related to Owner furnished products and transport, handle, store and protect products.
 - b. Manufacturers, suppliers, and vendor contacts and product names and numbers related to Owner furnished products.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 1. ASME A13.1 - Scheme for the Identification of Piping Systems.
- C. American National Standards Institute (ANSI):
 1. ANSI B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 2. ANSI B16.22 - Wrought Copper & Copper Alloy Solder-Joint Pressure.
- D. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 1. ASHRAE 90.1 - Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings.
- E. ASTM International (ASTM):
 1. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
 3. ASTM A536 - Ductile Iron Castings.
 4. ASTM A861 - High-Silicon Iron Pipe and Fittings.
 5. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.

6. ASTM B75 - Seamless Copper Tube.
 7. ASTM B88 - Seamless Copper Water Tube.
 8. ASTM B135 - Seamless Brass Tube.
 9. ASTM B306 - Copper Drainage Tube (DWV).
 10. ASTM B584 - Copper Alloy Sand Castings for General Applications.
 11. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 12. ASTM C921 - Determining the Properties of Jacketing Materials for Thermal Insulation.
 13. ASTM C1277 - Shielded Couplings Joining Hubless Castiron Soil Pipe and Fittings.
 14. ASTM C1540 - Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
 15. ASTM D1785 - Poly vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 16. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
 17. ASTM D2467- Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 18. ASTM D2564 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
 19. ASTM D2609 - Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
 20. ASTM D2665 - Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
 21. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
 22. ASTM D3311 - Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
 23. ASTM E84 - Surface Burning Characteristics of Building Materials.
 24. ASTM E96 - Water Vapor Transmission Materials.
 25. ASTM F439 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 26. ASTM F441 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 And 80.
 27. ASTM F493 - Solvent Cements for CPVC Pipe and Fittings.
 28. ASTM F656 - Primers For Use in Solvents Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 29. ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.
 30. ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.
 31. ASTM F1807 - Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) tubing.
 32. ASTM F1960 - Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
 33. ASTM F2014 - Non-Reinforced Extruded Tee Connections for Piping Applications.
 34. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Plastic Piping to Hot Chlorinated Water.
 35. ASTM F2098 - Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert Fittings.
 36. ASTM-F2389 – Pressure-rated Polypropylene (PP) Piping Systems.
- F. American Water Works Association (AWWA):
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 3. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
 4. AWWA C651 - Disinfecting Water Mains.
- G. Hydraulic Institute (HI):
1. HI M103 (ANSI/HI 1.4) - Centrifugal Operations.
- H. International Association of Plumbing and Mechanical Officials (IAPMO)
1. IAPMO/ANSI Z1001- Prefabricated Gravity Grease Interceptors.
- I. NSF International (NSF):
1. NSF 14- Plastic Piping System Components and Related Materials.
 2. NSF 51 – Food Equipment Materials
 3. NSF 61 – Drinking Water System Components-Health Effects.
 4. NSF 61 Annex G - Weighted Average Lead Content Evaluation Procedure to a 0.24 Percent Lead Requirement.
- J. Plumbing and Drainage Institute (PDI):

1. PDI WH 201- Water Hammer Arrestors.

K. Underwriters Laboratories (UL):

1. UL 778 – Motor-Operated Water Pumps.

1.3 SUBMITTALS

A. Comply with the requirements of Section 01330.

B. Product Data: Submit product data and installation details for grease interceptor to Authority Having Jurisdiction for approval. Include rated capacities, operating characteristics, and accessories.

C. Water Samples: Submit to Authorities Having Jurisdiction in accordance with the requirements of Cleaning and Disinfection paragraph in Part 3.

1.4 CLOSEOUT SUBMITTALS

A. Submit the following as described in the testing and inspection requirements in Part 3 below as a part of closeout submittals in accordance with Section 01770.

1. Video Inspection Report: Furnish one copy of Video Inspection Report to Owner's Construction Manager within one week after completion of inspection.

2. Certification: Provide statement of certification of the following:

a. Statement of completion that Work is in accordance with specified requirements.

b. Name and signature of General Contractor.

c. Names and signatures of Video Inspection Contractor.

3. Polypropylene Pipe Warranty.

1.5 QUALITY ASSURANCE

A. Domestic Water Supply Copper Piping Assembly Installer Qualifications: If Contractor provides any of the optional domestic water supply copper piping assembly systems specified in Part 2, Installer shall be a certified installer of system provided.

B. Regulatory Requirements:

1. Lead-Free Compliance: Domestic water piping and fittings, pumps, water piping specialties and specialty plumbing fixtures shall comply with the requirements of NSF 61 Annex G.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle products in compliance with the requirements of Section 01600.

B. Store and protect products in compliance with the requirements of Section 01600.

C. Product Delivery:

1. Owner's Supplier will deliver Owner furnished products to site to be received by Contractor. Contact Owner's Supplier to coordinate product delivery and installation.

2. Schedule delivery of items to installation areas that are in proper condition to receive them. Place items neatly and systematically to avoid damage, store in clean, dry, enclosed, and secure storage area.

3. Receive Owner Furnished products in compliance with the requirements of Section 01600.

D. Acceptance at Site:

1. Inspect Owner furnished products upon delivery of products to Site to verify quantity of products furnished and report to Owner discrepancies in quantity delivered or obvious damage to products delivered to the site.

2. Inspect materials delivered and reject those not qualifying with requirements, those damaged in transit, or those that appear otherwise unsatisfactory.

- E. Polypropylene piping shall remain in its UV resistant packaging until ready to be installed. If the piping is to be exposed to the sun for more than 30 days, take appropriate measures to protect the pipe from UV radiation.

1.7 WARRANTY

- A. Provide manufacturers warranty for polypropylene (Aquatherm) pipe and fittings for 10 years to be free of defects in materials or manufacturing.
- B. Warranty shall cover labor and material costs of repairing or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
- C. Contractor shall submit to the manufacturer, the pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test in order to receive the warranty from the manufacturer. Submit pressure test to Aquatherm at <http://www.aquatherm.com/pressure-test-submission>.

PART 2 - PRODUCTS

2.1 OWNER FURNISHED PRODUCTS

- A. Owner's Suppliers will furnish the following products as specified in Appendix A (Section 15100) and shown on the drawings for installation by either Contractor or Owner.
 - 1. Water piping specialties.
 - 2. Drainage piping specialties.
 - 3. Domestic water booster pumps.
 - 4. Garden center watering mats.

2.2 DOMESTIC WATER PIPING

- A. Water Piping Above Grade:
 - 1. Type "L" hard drawn, seamless copper water tube, ASTM B88.
 - 2. Jointing: Join with wrought copper pressure fittings, ANSI B16.22. Make joints using "lead free" solder and a non-corrosive, paste-type flux. Core solder is not permitted. Solder shall be solid string or wire type. Where soldered copper piping is connected to threaded brass piping, use cast brass adaptor.
 - 3. At Contractor's option, in lieu of a soldered copper piping system as specified above, any of the following copper pipe assembly systems may be used.
 - a. CTS Copper Grooved Piping System by Victaulic Company of America: Copper tubing systems from 2 inch through 8 inch shall be installed using mechanical pipe couplings of a bolted type, with pressure-responsive gaskets and grooved end copper or bronze fittings. The CTS System shall include the following components:
 - 1) Copper Tube: Type "L" hard drawn, seamless copper water tube, ASTM B88.
 - 2) Mechanical Couplings: Style 606 rigid couplings 2 inch – 8 inch for copper consisting of a ductile iron cast housing, a synthetic rubber gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together.
 - 3) Coupling Housings: Ductile iron conforming to ASTM A536, Grade 65-45-12, with a copper color alkyd enamel paint coating.
 - 4) Gaskets: Molded of Grade "E" EPDM synthetic rubber, conforming to ASTM D2000, designation 2CA615A25B24F17Z, and recommended for potable water service within the specified temperature range of -30 to +230 degrees F. Gaskets shall conform to the copper tube size (CTS) outside diameter and coupling housing inside diameter.
 - 5) Flange Adapters: Style 641 adapters 2 inch - 6 inch, ductile iron ASTM A536, Grade 65-45-12, engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer shall provide standard flange bolts.
 - 6) Fittings: Full flow copper fittings with grooves designed to accept Victaulic grooved end couplings. Fittings shall be copper per ASTM B75 alloy C12200; or bronze sand castings per ASTM B584 copper alloy CDA 844 (81-3-7-9) per ANSI B16.18. Use Style 47 dielectric waterways when connecting dissimilar metals in liquid systems.

- 7) Valves: Series 608 Butterfly valves, 2-1/2 inch – 6 inch, 300 psi, with grooved ends, cast bronze body to CDA-836 (85-5-5-5), rubber encapsulated ductile iron disc, ASTM A536, Grade 65-45-12. Bubble tight, dead-end or bi-directional service as required.
 - b. Press-connect copper pipe fitting system by one of the following:
 - 1) ProPress by Viega.
 - 2) Xpress by Elkhart Products Corporation.
 - 3) Presssystem by NIBCO.
 4. Mechanically formed tee fitting system by T-Drill Industries in accordance with ASTM F 2014.
 5. Crosslinked PE (PEX) Tubing:
 - a. PEX Tube: Tube shall be tested and certified for potable water systems, and shall comply with ANSI/NSF Standard 14, ANSI/NSF Standard 61, and ASTM F876 and/or ASTM F877. Tube shall be labeled with the above certifications.
 - b. Provide PEX tubing system by one of the following:
 - 1) NIBCO, Inc
 - 2) REHAU
 - 3) Uponor (Formerly/Wirsbo)
 - 4) Watts Water Technologies
 - 5) Zurn Engineered Water Solutions
 - c. Tube shall be white in color.
 - d. Fittings: Lead free brass or copper fittings, copper crimp connectors, stainless steel clamp connectors and cold expansion sleeves shall be tested and certified for potable water systems and shall comply with one of the following Standards: ASTM F1807, ASTM F1960, ASTM F2098.
 - e. PEX tube, brass or copper fittings and connectors shall be by the same manufacturer and assembled with the manufacturer's approved tools. The same connection method shall be used throughout the installation.
 6. Polypropylene (PP-R) Piping:
 - a. Polypropylene (PP-R) piping SDR 7.4 (faser) for hot water and SDR 11 (non-faser) for cold water.
 - b. Pipe and fittings shall be Aquatherm® Greenpipe manufactured by Aquatherm, Inc.. Lindon, Utah, (801) 805-6657, www.aquathermpipe.com.
 - c. Pipe shall be tested and certified for potable water systems, and shall comply with ANSI/NSF Standard 14, ANSI/NSF Standard 61, ASTM F2023, ASTM F2389 and ASTM D635. Pipe shall be labeled with the above certifications.
 - d. PP pipe, fittings and adapters shall be by one manufacturer. Use only manufacturer approved heat fusion tools.
 - e. Fittings: Connections and transition to other pipe material or types shall be made by manufacturer approved products and tools.
 - f. Valves with PP-R bodies shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The valves shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. Valves shall be Aquatherm® Fusiotherm® by Aquatherm.
- B. Water Piping Below Grade (Under Slab):
1. 1-1/2 Inches and Smaller:
 - a. Crosslinked PE (PEX) tubing, ASTM F876 without joints beneath the slab.
 - b. Type "K" soft copper without joints beneath slab.
 2. 2 Inches and Larger: Type K hard drawn with brazed fittings.
- C. Chrome-Plated Seamless Brass Tube: ASTM B135.
- D. Insulation:
1. Manufacturers: Subject to compliance with requirements, provide insulation as manufactured by one of the following:
 - a. CertainTeed.
 - b. Imcoa (Nomaco K-Flex).
 - c. Knauf.
 - d. Owens-Corning.

- e. Johns Manville.
- f. Armacell.
- 2. Provide one of the following types of insulation throughout the project:
 - a. Rigid Glass Fiber: Type ASJ/SSL, maximum k factor at 75 degrees F of 0.23 Btu-in/hr.f.sq ft, 3 lb/cu.ft density. Vapor barrier jacket shall be white kraft paper with glass fiber yarn, bonded to aluminized film conforming to ASTM C921, with a maximum moisture vapor transmission rate of 0.02 perm-inch in accordance with ASTM E96. Insulate fittings with PVC covers with glass fiber inserts.
 - b. Polymer Foam Insulation: Arctitherm by Imcoa or equal. Maximum k factor at 75 degrees F of 0.25 Btu-in/hr.f.sq ft, 1.5 lbs/cu. ft. density, maximum flame spread and smoke development of 25 and 50, respectively per ASTM E84. Insulate fittings with pre-formed foam covers.
 - c. Elastomeric Flexible Closed Cell Insulation: AP Armaflex W (white) by Armacell or equal. Maximum k factor at 75 degrees F of 0.28 Btu-in/hr.f.sq ft, maximum flame spread and smoke development of 25 and 50, respectively. Insulate fittings per manufacturer's recommendations.
- 3. Insulation Color: White.
- 4. Insulation Thickness: Provide minimum insulation thickness for water piping in compliance with ASHRAE 90.1 and the following:
 - a. Hot Water:
 - 1) Branch runouts for nonrecirculating systems up to 1-1/2" in diameter and less than 12 feet in length: 1/2 inch insulation.
 - 2) Pipes 2 inch in diameter and less: 1 inch insulation.
 - 3) Pipes 2-1/2 inch to 4 inch: 1-1/2 inch insulation.
 - b. Cold Water: 1/2 inch insulation.

2.3 REVERSE OSMOSIS WATER SYSTEM PIPING

- A. Piping Above Grade: CPVC plastic pipe, ASTM F 441, Schedule 80, plain ends.
 - 1. CPVC Plastic Pipe Fitting: ASTM F439, Socket-type fittings, Schedule 80 fittings.
 - 2. CPVC Solvent Cement: ASTM F493.
 - 3. CPVC Primer: ASTM F656.
 - 4. Crosslinked PE (PEX) tubing, ASTM F876
- B. Piping Below Grade: Crosslinked PE (PEX) tubing, ASTM F876. Joints shall not be used under slab.
- C. Plastic Ball Valve: 150-psig working pressure, 250 degree F maximum operating temperature, full port design, 1 or 2 piece body design, CPVC body and ball, polytetrafluoroethylene seats, EPDM seals, and tee handle with socket connections.
- D. Piping and fitting shall carry the NSF International (NSF) Seal of Approval for potable water application.
- E. Final Connection Tubing.
 - 1. Final Connection Tubing: Crosslinked PE (PEX) tubing, ASTM F876 with insert fittings conforming to ASTM D2609.

2.4 SANITARY WASTE AND VENT PIPING

- A. Soil, Waste, and Vent Piping: Provide any of the following as applicable:
 - 1. PVC Pipe: May be used for sanitary drainage pipes (drain, waste, and vent) where permitted by Authority Having Jurisdiction.
 - a. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent. Cellular (foam) core PVC not permitted.
 - b. PVC Socket Fittings, ASTM D2665, made to ASTM D3311, drain, waste, and vent patterns.
 - 2. Cast Iron: Cast iron soil pipe and fittings, coated inside and outside, ASTM A74 or ASTM A888. Provide weight of pipe as required by code for location and duty.
 - 3. Ductile-Iron Pipe: AWWA C151 or AWWA C115 ductile-iron pipe, with AWWA C104 cement-mortar lining.
 - 4. Copper Drainage Tubing (Above grade only): Copper drainage tubing conforming to ASTM B306.

5. ABS Pipe: Not Permitted.

B. Joints:

1. Cast Iron Pipe: Push-on compression gasketed type joint for hub and spigot, ASTM C564. No-hub mechanical joints with center stops, ASTM C1277 or ASTM C1540.
2. PVC Pipe: Solvent-welded joints.
3. Copper Drainage Tubing: Join with wrought copper pressure fittings, ANSI B16.22. Make joints using "lead free" solder and a non-corrosive paste type flux. Core solder shall not be used. Solder shall be solid string or wire type.

C. Traps:

1. Provide deep seal P-traps for floor drains, including drains furnished as integral parts of floor-type mop basins, and similar fixtures.

2.5 AIR CONDITIONING CONDENSATE PIPING

A. Condensate Trap: Install trap furnished with RTU.

B. Condensate Piping Above the Roof: ASTM A 53, Schedule 40 galvanized steel with galvanized malleable iron or galvanized steel fittings.

C. Condensate Piping Below the Roof: PVC plastic pipe and fittings conforming to requirements specified for sanitary waste and vent piping hereinbefore.

D. Insulation: As specified for domestic water piping, 1/2 inch thick for condensate piping below the roof.

2.6 WASTE COOKING OIL PIPING

A. Outlet (Discharge) and exterior Vent Piping including penetration through wall or roof: ASTM A53 Schedule 40 galvanized steel pipe with 150 lb galvanized steel threaded fittings.

A. Interior Vent Piping: ASTM A53 Black Steel, standard weight, welded or threaded with malleable iron fittings including couplings.

B. Interior Pipe Escutcheons: Chrome-plated, stamped, steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in walls.

1. Manufacturers: Subject to compliance with requirements, provide escutcheon as manufactured by one of the following:
 - a. Chicago Specialty Manufacturing Company.
 - b. Tubular Brass Plumbing Products, Zurn Industries, Inc.

C. Exterior Pipe Escutcheons: 304 Stainless Steel. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in walls.

2.7 PUMPS (OWNER FURNISHED, CONTRACTOR INSTALLED)

A. Subject to compliance with Project requirements, install owner furnished pumps of manufacturers, types, and model numbers as indicated on the Pump Schedules on the Drawings. Pumps shall include sump pumps and domestic water booster pumps to the extent shown, and accessories as scheduled and specified below.

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

2.8 TRUCK WELL PUMPS

A. Subject to compliance with Project requirements, provide pumps of manufacturers, types, and model numbers as indicated on the TRUCK WELL SUMP PUMP SCHEDULE on the Drawings.

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

2.9 WATER PIPING SPECIALITIES (OWNER FURNISHED, CONTRACTOR INSTALLED)

- A. Subject to compliance with Project requirements, install owner furnished piping specialties of manufacturers, types, and model numbers as indicated on the Plumbing Schedules on the Drawings. Water piping specialties shall include such items as hose bibbs, hydrants, valves, vacuum breakers, mixing valves, pressure reducing (regulating) valves, expansion tanks and accessories therefor.

2.10 SPECIALTY PLUMBING FIXTURE.

- A. Subject to compliance with Project requirements, provide plumbing fixture specialties of manufacturers, types, and model numbers as indicated on the SPECIALTY PLUMBING FIXTURE SCHEDULE on the Drawings. Plumbing fixture specialties shall include such items as backflow preventers, water hammer arresters, trap primers, and ball valves

2.11 DRAINAGE PIPING SPECIALITIES (OWNER FURNISHED, CONTRACTOR INSTALLED)

- A. Subject to compliance with Project requirements, install owner furnished piping specialties of manufacturers, types, and model numbers as indicated on the Plumbing Schedules on the Drawings. Drainage piping specialties shall include floor and roof drains, deck drains, cleanouts and accessories therefor.

2.12 GREASE INTERCEPTORS

- A. Provide grease interceptor and associated piping as shown on the drawings and as acceptable to the Authority Having Jurisdiction. Minimum size shall be as indicated.

2.13 SUBSTITUTIONS

- A. Reference Section 01600.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install piping and accessories at locations and of sizes shown on the drawings.
- B. Install proprietary piping systems, accessories, and products in accordance with manufacturer's published instructions.
- C. Connect piping and fittings in accordance with manufacturer's instructions using specialty tools as required and recommended by the manufacturer.
- D. Install piping neatly and parallel with, or perpendicular to, lines of the structure. Install pipe hangers as specified in Section 15050 to maintain accurately aligned piping systems, adequately supported both laterally and vertically.
- E. Provide Schedule 40 steel pipe sleeve, minimum of one size larger than the protected pipe, for underground piping routed beneath structural footings. Extend sleeve 24 inches in both directions beyond the footing.
- F. Where practical, connect two or more vents together and extend as one vent through roof. Make vent connections to stacks by appropriate use of 45 degree wyes, long sweep quarter bends, sixth, eighth, or sixteenth bends, except that sanitary tees may be used on the vertical stacks.
- G. Extend vent piping 12 inches above roof line or more if required by Authority Having Jurisdiction. Coordinate installation with roofing.
- H. Conceal piping in chases, interior walls, furred spaces, and above ceiling.

- I. Identify nonpotable water systems by color markings or metal tags in accordance with ASME A13.1.
- J. Make piping connections to fixtures and equipment with chrome-plated seamless brass tube with cleanout plug and escutcheon.
- K. For items to be installed on split face CMU, grind surface of CMU to a smooth finish for tight installation. Seal with silicone sealant in accordance with Section 07900.
- L. PEX Domestic Water Tubing:
 - 1. Install piping similar to copper piping as shown on drawings. Do not use manifold system.
 - 2. Protect tubing from UV radiation during pre-installation storage and after installation.
 - 3. Provide adequate tubing length for contraction and expansion of tubing.
 - 4. Tubing may be bundled. Do not bundle cold water lines with hot water or hot water return lines.
 - 5. Protect tubing routed through metal studs with grommets or sleeves at each stud.
 - 6. Do not install PEX tubing in masonry walls.
 - 7. Install type "L" copper pipe at the inlet and outlet of the water heater, minimum 18 inches long.
 - 8. Utilize water hammer arrestors as specified for the copper tube system.
 - 9. Tubing sizes shall be as shown on the Equivalent Pipe Size Schedule on the drawings.
 - 10. Coordinate PEX to plumbing fixture fittings with the furnished fixture accessories.
 - a. Use copper stub-outs and stub-out brackets secured to wall for fixtures furnished with compression stops.
 - b. Do not use PEX for flush valves.
 - 11. Provide recommended methods for controlling thermal expansion in hot water piping for straight runs every 50 feet.
- M. Polypropylene (PP-R)
 - 1. Install piping similar to copper piping as shown on drawings.
 - 2. Store piping and fittings in factory-issued protective bag until immediately prior to installation to protect the pipe from dust, scratches and UV radiation damage.
 - 3. Utilize water hammer arrestors as specified for the copper pipe system.
 - 4. Pipe sizes shall be as shown on the Equivalent Pipe Size Schedule on the drawings.
 - 5. Coordinate piping to plumbing fixture fittings with the furnished fixture accessories.
 - a. Use copper stub-outs and stub-out brackets secured to wall for fixtures furnished with compression stops.
 - b. Use manufacturer's threaded fittings for connections to flush valves.
 - 6. Fusion Welding of Joints
 - a. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting type.
 - b. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
 - c. Prior to joining, the pipe and fittings shall be prepared in accordance with F 2389 and the manufacturer's specifications.
 - d. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications
 - 7. Provide recommended methods for controlling thermal expansion in hot water piping for straight runs every 120 feet.

3.2 PIPING INSULATION - INSTALLATION

- A. Domestic Hot and Cold Water Lines: Insulate lines above slab.
- B. Reverse Osmosis piping: Do not insulate
- C. Interior Air Conditioning Condensate Piping: Insulate condensate piping below roof.

3.3 PUMP INSTALLATION

- A. Install pumps where shown on the drawings and in accordance with manufacturer's instructions.
- B. Pump Installation Standard: Comply with HI M103 for installation of sump and domestic water pumps.

3.4 WATER PIPING SPECIALITIES INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment where shown and water systems that may be sources of contamination. Comply with Authorities Having Jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valves and pressure-reducing valves.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. 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.
- H. Drawings indicate general arrangement of piping and specialties.

3.5 LABELING AND IDENTIFYING

- A. Equipment Nameplates (for new equipment): Manufacturer's standard 3/32 inch thick black plastic laminate nameplates with 5/32 inch holes for fasteners. Provide nameplates and signs no smaller than 1-1/2 inches square.
 - 1. Provide engraved white lettering indicating piping system abbreviation in characters 1/4 inch high and sequenced valve numbers in characters 1/2 inch high.
- B. Signs: In addition to identifying unit, provide signs which distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operation.
- C. Install equipment nameplate or sign on or near each of the following new items:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Water pressure-reducing valves.
 - 5. Primary, thermostatic, water mixing valves.
 - 6. Supply-type, trap-seal primer valves.

3.6 DRAIN PIPING SPECIALTIES INSTALLATION

- A. 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.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. 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. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. 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.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. 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.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install grease interceptors, including trapping, venting, and flow-control fitting, according to Authorities Having Jurisdiction and with clear space for servicing.
 - 1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
 - 2. Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- 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.

3.7 CLEANING AND DISINFECTION

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by Authorities Having Jurisdiction. If methods are not prescribed, use procedures described in AWWA C651 or follow procedures described as follows:
 - 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. After the standing time, flush system with clean, potable water until the chlorine is purged from the system.

- B. Submit water samples in sterile bottles to Authorities Having Jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Reports: Prepare disinfection reports signed by the Authority Having Jurisdiction and submit to Architect with Closeout Submittals.

3.8 FIELD QUALITY CONTROL

A. Pipe Tests:

1. Test plumbing drainage systems under 10 foot static head for a period of not less than 24 hours.
2. Test water systems under 150 psig hydrostatic pressure.
3. Test underground piping prior to backfilling and before installing equipment and before insulation is applied, using specified methods and conditions. Subject piping to test for not less than 24 hours. Make necessary replacements or repairs and repeat tests until entire system, including equipment, is accepted as satisfactory.
4. Pressure test PEX piping systems in accordance with the manufacturer's requirements. Do not exceed 150 psig.
5. Pressure test PP piping in accordance with manufacturer's Installation Manual.
6. Install equipment, operate systems, clean out scale, dirt, oil, waste, and foreign matter, and correct additional leaks.
7. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to Authorities Having Jurisdiction and the device's reference standard.
8. Pipe tests specified in this Section shall be to five feet outside building lines or to point of connection to exterior lines. Drains to oil/grease interceptor (separator) shall be tested to the point of the oil/grease interceptor outlet.

B. Underground Piping Video Inspection (At the discretion of the Walmart Construction Manager)

1. General: Perform video inspection of underground sewer piping from the point of connection to the manhole outside the building through the mains and through the single takeoff to each fixture.
2. When there are problems with existing sewer piping, perform video inspection of existing sewer piping and coordinate repair of deficiencies with Owner's Construction Manager. An equitable adjustment will be made in the contract price for additional work directed and performed.
3. Video Inspection Contractor Qualifications: Specified in Part 1.
4. Video Inspection Certification: Provide video inspection certification as specified in Part 1.
5. Video Taping Requirements:
 - a. Video camera designed for express purpose of sewer line inspection.
 - b. Camera and apparatus capable of extending to all points of piping required within 2 inch to 8 inch diameter pipe.
6. Procedure:
 - a. Inspect sewer pipes with video camera no earlier than 30 days after floor slab has been poured. Sections of sewer determined to be deficient shall be uncovered and repaired or replaced to satisfaction of Owner. Retest repaired section.
 - b. Adequately flush and clean sewer piping prior to video inspection
 - c. Provide additional video inspection at contractor's expense if there are clogging problems within the first year warranty and if requested by owner.
7. Video Inspection Report:
 - a. Submit in accordance with requirements in Part 1.
 - b. Submit bound report in MS Word format.
 - c. Provide summary report of pipes inspected and defects noted
 - d. Log shall show the exact measure location of faults such as, but not limited to:
 - 1) Open joints.
 - 2) Broken, cracked or collapsed pipe.
 - 3) Accumulation of debris or obstructions.
 - 4) Evidence of infiltration.
 - 5) Water depth variation and sags.
 - 6) Protrusions.

- e. The reference location shall include the distance away from the reference point of entry such as manhole or cleanout and the position of the fault as to the bottom, top or side of the pipe.
- f. Provide plan of piping network covered with notations.

3.9 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

3.10 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