SECTION 221100 – DOMESTIC/LABORATORY WATER PIPING SYSTEMS & SPECIALITIES

Latest Update: 12-17-2021 See Underlined Text for Edits

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 22.

1.2 SUMMARY

A. This section includes the requirements for domestic and/or laboratory water piping and specialties above ground within the building, and water service piping below the floor slab or underground to five (5) feet outside the building, and includes the following**:**

<Delete piping and specialties not applicable to this project>

1. Copper tubing and fittings.
2. Grooved copper pipe and fittings.
3. Ductile iron pipe and fittings.
4. Gaskets.
5. Transition fittings.
6. Strainers.
7. Dielectric connections.
8. Vacuum breakers
9. Backflow preventers.
10. Outlet boxes.
11. Hose bibbs.
12. Wall hydrants.
13. Water-hammer arresters.
14. Air vents.
15. Trap-seal primer valves and systems.
16. Flexible connectors.
17. Water meters.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, and warranty information.

B. LEED Submittals:<Delete if not a LEED project>

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation & Maintenance Manual: Include a copy of each approved submittal along with any applicable maintenance data in the project operation and maintenance manual.

1.6 PERFORMANCE REQUIREMENTS

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

1.7 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be a qualified licensed installer within the jurisdiction and familiar with the installation of the pipe and fittings specified herein for each piping system.

B. Compliance: Potable-water piping and components shall comply with NSF 14 and NSF 61.

C. Source Limitations: Obtain pipe and fittings from the same manufacturer for each pipe system.

1.8 FIELD CONDITIONS

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

1. Notify Construction Manager no fewer than five (5) days in advance of proposed interruption of water service.

2. Do not interrupt water service without Construction Manager's written permission.

1.9 WARRANTY/GUARENTEE

A. See Division 22, Specification Section "Basic Mechanical Requirements – Plumbing" for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Material Design and Selection: Domestic and Laboratory water pipe, fittings, and specialties shall be designed and selected, for the intended use, in accordance with the sizes on the drawings and the requirements of this specification.

B. Acceptable Manufacturers: Acceptable manufacturers shall be as follows:

1. Ductile Iron Piping Systems: All ductile iron pipe and fittings shall be by one (1) manufacturer.

a. American Cast Iron Pipe Company.
b. US Pipe Company.
c. Atlantic States Cast Iron Pipe Company.

2. Copper Tube Piping Systems:

a. Solder Joint Copper Tube and Fittings: All copper tube and/or fittings for solder joint application shall be by one (1) manufacturer.

1) Mueller Industries

b. Press Type Copper Piping Systems: The basis of design is Viega ProPress copper piping system. Other acceptable manufacturers are:

1) Elkhart Products Corporation – Apollo XPress.

c. Grooved Copper Piping Systems: The basis of design is Victaulic grooved copper piping system. Other acceptable manufacturers are:

1) Gruvlok Inc.

3. Dielectric Fittings:

a. Unions: Watts, Zurn and Capitol Manufacturing Company.
b. Flanges: Watts, Zurn and Capitol Manufacturing Company.
c. Insulating Kits: Pipeline Seal and Insulator Company, Calpico, Inc.

d. Nipples: Victaulic, Precision Plumbing Products, Inc. and Elster Perfection

4. Vacuum Breakers: Watts, or Zurn.

5. Backflow Preventers: Watts, or Zurn.

6. Outlet Boxes: Oatey, Acorn Engineering Company or LSP Products Group Inc.

7. Wall Hydrants and Hose Bibbs: Josam or Zurn.

8. Water Hammer Arresters: Jay R. Smith, AMTROL, Inc., or Ancon.

9. Trap Primer Devices: Sloan, E&S Primer Valve, Zurn or Josam.

10. Flexible Connectors: Metraflex Corporation or approved equal

2.2 DOMESTIC AND LABORATORY WATER PIPE MATERIAL APPLICATION

A. General Application: All pipe, fittings and joint methods shall be as specified below. For this application, Domestic Water Piping Systems are defined as follows:

1. Building Water Service Piping System: Cold Water piping from the meter vault to the building and up through the floor slab.
2. Domestic (Potable) Water Piping Systems: Includes Cold Water, Hot Water, and Hot Water Recirculating Piping serving non-laboratory areas of the building or project area.
3. Laboratory (Non – Potable) Water Piping Systems: Includes Cold Water, Hot Water, and Hot Water Recirculating Piping serving laboratory areas of the building or project area.

B. Domestic Water Pipe Material Application Schedule:

Pipe System	Pipe Material	Fitting Material	Joint Method
Building Water Service to 5 feet beyond building Underground	Copper Tube: 1 inch to 2-1/2 inch, ASTM B88, Type 'K', Seamless, Water Tube, hard drawn temper.	Copper Fittings: 1 inch to 2-1/2 inch, ASTME B16.22, wrought copper or copper alloy solder joint, 150 lb.	Soldered: ASTM B32, alloy Sb5 (95% tin, and 5% antimony), with 0.2% maximum lead content. ASTM B813 water flushable flux.
Building Water Service to 5 feet beyond building Underground	Ductile Iron: Piping 3 inch and larger: AWWA C151/A21.15 or AWWA C104 cement motor lining.	Ductile Iron: Fittings 3 inch and larger: AWWA C110 or AWWA C153/A21.53 with AWWA C104 cement motor lining.	Push on or mechanical joints and gaskets: AWWA C111/A21.11.
Domestic and Laboratory Cold, Hot, and Hot Water Circulating piping, Above Ground within the building	Copper Tube: 1/2 inch to 2 inch, ASTM B88, Type 'L', Seamless, Water Tube, hard drawn temper.	Copper Fittings: 1/2 inch to 2 inch, ASTME B16.22, wrought copper or copper alloy solder joint, 150 lb.	Soldered: ASTM B32, alloy Sb5 (95% tin, and 5% antimony), with 0.2% maximum lead content. ASTM B813 water flushable flux.
		1/2 inch to 2 inch Viega ProPress copper fittings with EPDM seals. (Contractor Option)	Viega ProPress connection with EPDM sealing element. (Contractor Option)
	2-1/2 inch to 4 inch: Copper Tube: ASTM B88, Type 'L', Seamless, Water Tube, hard drawn temper (Contractors Option)	2-1/2 inch to 4 inch Viega ProPress XL-C copper fittings with EPDM seals. (Contractor Option)	Viega ProPress connection with EPDM sealing element. (Contractor Option)

Pipe System	Pipe Material	Fitting Material	Joint Method
Domestic and Laboratory Cold, Hot, and Hot Water Circulating piping, Above Ground within the building	Grooved Copper Tube: 2-1/2 inch to 8 inch, ASTM B88, Type 'L', Seamless, Water Tube, hard drawn temper.	Fittings: 2-1/2 inch to 8 inch, copper coated Ductile Iron Grooved End Fittings for Elbows, Tees, Increasers, Reducers, 'Y' Fittings, conforming to ASTM A - 395, grade 65-45-15.	Couplings: Vic Style 606 copper coated Ductile Iron couplings with Grade 'E' EPDM gasket material, Carbon Steel Nuts and Bolts, conforming to ASTM A-563, grade 65-45-12 Vic Flange Adapters: Vic Style 641, copper coated Ductile Iron, conforming to ASTM A -536, grade 65-45-12.
Domestic and Laboratory Cold, Hot, and Hot Water Circulating piping, Above Ground within the building	Pipe: 4 inch to 8 inch: Victaulic rolled grooved end Schedule 10S Stainless Steel pipe, 150 lb. ANSI Class, ASTM A 312, ASME SA 312 by Victaulic Corp. USA. (Contractors Option)	Fittings: Stainless Steel Grooved End Fittings for Elbows, Tees, Increasers, Reducers, 'Y' Fittings, conforming to ASTM A - 351, grade CF8 (304) (Contractors Option)	Joints: Vic Style E 497 - Flex Rigid Ductile Iron couplings with Grade 'EHP' EPDM gasket material, Carbon Steel Nuts and Bolts, conforming to ASTM A-563M, Class 9, ASTM A - 183. Vic Flange Adapters: Vic Style E 498, Stainless Steel, conforming to ASTM A - 403, Class WP. (Contractors Option)

2.3 DUCTILE-IRON PIPE FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

2.4 COPPER TUBE MISCELLANEOUS FITTINGS

A. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

B. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.7 VICTAULIC PIPE EXPANSION COMPENSATION

A. Victaulic – Copper System: Victaulic Style 606 Couplings and Victaulic No. 610 90º Elbows to form the appropriate sized copper tube expansion loop.

B. Victaulic – Stainless Steel System: Victaulic Style E 155 stainless steel expansion joint with roll grooved ends.

1. Option: Victaulic S 177N Quick Vic Flex Coupling with Victaulic 8494G Adaptor Nipples.

2.8 STRAINERS

A. Copper Piping Three (3) Inch and Smaller: Mueller Model LF 352 Y pattern lead free strainer, 250 psig working pressure; brass body with threaded ends, conforming to ASTM B 61, and perforated 20 mesh Type 304 stainless steel screen, blow-down drain with plugged valve and threaded hose connection.

2.9 DIELECTRIC CONNECTIONS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples:

1. Piping Two (2) Inch and Smaller: Provide Schedule 40 unlined type 316 stainless steel nipples, four (4) inches long with thread ends.

C. Dielectric-Flange Insulating Kits:

1. Piping Two and One Half (2-1/2) Inch and Larger: Provide Type 'E' Full Flanged Isolation Gasket Kits with Dialectic Insulators for the pipe flanges.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: [150 psig] <Insert value>.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.10 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze or Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, non-removable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated or Rough bronze.

2.11 BACKFLOW PREVENTERS <Designer shall apply type of preventer as required by plumbing code.>

A. General: All backflow preventers used in plumbing systems must be constructed of lead free materials and be NSF-61 approved.

B. Backflow Preventer Types:

1. Reduced-Pressure Backflow Preventers:
   a. Standard: ASSE 1013.
   b. Operation: Continuous-pressure applications.
   c. Pressure Loss: 12 psig maximum, through middle third of flow range.
   d. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
   e. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   f. Configuration: Designed for horizontal, straight-through flow.
   g. Accessories:

      1) Valves: See Valve section
      2) Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2. Double-Check, Backflow-Prevention Assemblies:
   a. Standard: ASSE 1015.
   b. Operation: Continuous-pressure applications unless otherwise indicated.
   c. Pressure Loss: 5 psig maximum, through middle third of flow range.
   d. Body: Bronze.
   e. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   f. Configuration: Designed for horizontal, straight-through flow.

3. Hose Connection Backflow:
   a. Standard: ASSE 1052.
   b. Operation: Up to ten (10) foot head of water back pressure.
   c. Inlet Size: NPS 1/2 or NPS 3/4.
   d. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
   e. Capacity: At least three (3) gpm flow.

C. Water Service Applications:

1. Building Water Service: Watts LF 909 Series reduced pressure double check valve backflow preventer with strainer, intermittent drain with air gap fitting, and two (2) valves for two (2-1/2) inch and larger piping systems or approved equal.

2. Hydronic Make Up Water Systems: Watts series LF-009-QT with a strainer, two (2) ball valves and one (1) air gap fitting, for one (1) to two (2) inch piping systems.

3. Mop Sink Housekeeping Connection: Watts series LF-009-QT with a strainer, two (2) ball valves and one (1) air gap fitting, for one half (1/2) inch pipe connection.

4. Small Appliances: Watts series LF7R dual check with a union on one end, one half (1/2) inch x one half (1/2) inch, NSF-61 approved. Small appliances include refrigerators, ice machines, coffee makers, and hot and cold water dispensers.

5. Hose Bibs: Watts series 8A.

2.12 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 ball valve and NPS 1/2 copper, water tubing.

2.13 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: Rough bronze.
9. Operation: Operating key.

2.14 WALL HYDRANTS

A. Non freeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.

2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

2.15 WATER HAMMER ARRESTERS

<Designer to provide amount of fixture units for each arrestor either by schedule or on the riser diagram>

A. Water Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows or Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes 'A' through 'F'.

2.16 AIR VENTS

A. Bolted Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140°F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 inch minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150 psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.17 TRAP PRIMER DEVICES AND SYSTEM

A. Trap Primer Device - Flush Valve Type:

1. See Division 22 Specification Section "Plumbing Fixtures and Accessories" for requirements.

B. Trap Primer System – Battery Powered:

1. Non Toilet Room Areas: Prime the floor drain trap using an automatic priming system similar to Precision Plumbing Products Model MP-500-12V battery operated trap primer mounted in a NEMA 1 UL 50, 16 gauge steel box with a screw on cover and a preset timer that opens once every ten (10) seconds every twenty four (24) hours. For applications serving more than one (1) floor drain provide a distribution unit for the trap primer lines. This trap primer system is not acceptable for mechanical equipment rooms. <Coordinate with UMB or if not required delete.>

C. Trap Primer System – Electric Powered:

1. Mechanical Equipment Rooms: prime the floor drain traps using an automatic priming system similar to Zurn Model Z1020 electric trap priming system complete with a galvanized steel enclosure one half (1/2) inch copper inlet connection, brass stop ball valve, slow closing 24VAC solenoid valve with a integral strainer, brass vacuum breaker, copper water way, anti-scaling multi-port manifold with [five (5) one half (1/2) inch copper connections] [ten (10) one half (1/2) inch copper connections] to deliver a six (6) second water injection every twenty four (24) hours, electronic module with a 110 VAC power connection, internal fuse, 110 V–24VAC transformer with internal wiring to the solenoid valve, and a removable cover panel.

2.18 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

B. Working-Pressure Rating: Minimum 200 psig.

C. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

D. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

E. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.19 CLEANING AND STERILIZATION OF DOMESTIC WATER SYSTEMS

A. See Division 22 Specification Section “Sterilization of Potable Water Systems” for cleaning and sterilizing the domestic water piping systems in the building.

2.20 BUILDING SERVICE DOMESTIC WATER ENERGY METER

A. Provide building service domestic water energy meter where indicated on the construction documents. See Division 23 Specification Sections for the “Building Automation Systems” for meter requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Install piping as indicated unless deviations to layout are approved on coordination drawings.

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

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

<Retain paragraph below if booster pumps are not required.>

D. Install domestic water piping level with 0.25% slope downward toward drain without pitch and plumb.

<Retain paragraph below if piping is required to withstand seismic design loads.>

E. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Division 22 Specification Section "Vibration and Seismic Controls for Plumbing Systems."

F. Install domestic water piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install domestic water 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.

H. Install domestic water piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install domestic water piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install domestic water piping free of sags and bends.

L. Install branch pipe connections off the top of the main pipe or on a 45-degree upward angle. Branch connections off the bottom of the main pipe are not acceptable.

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

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Division 22 Specification Section "Thermometers and Gauges for Plumbing Piping."

<Retain paragraph below if hot-water circulation pumps are controlled by thermostats.>

P. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Specification Section "Pumps for Plumbing Systems."

Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Specification Section "Thermometers and Gauges for Plumbing Piping."

R. Install pipe sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Specification Section "Sleeves, Sleeve Seals and Escutcheons for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Specification Section "Sleeves, Sleeve Seals and Escutcheons for Plumbing Piping."

T. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Specification Section "Sleeve, Sleeve Seals and Escutcheons for Plumbing Piping."

3.2 PIPE SPECIALTIES INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Where required install outlet boxes recessed in wall or surface mounted on wall. Install two (2) inch by four (4) inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Architectural Specification Section "Rough Carpentry."

C. Set non-freeze, non-draining-type post hydrants in concrete or pavement.

<Water-hammer arresters in paragraph below are best shown on water risers and details. Specifying number, size, and location here is difficult.>

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

E. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

F. Trap Primer Device – Flush Valve: Install trap primer line from the water closet flush valve to the FD with outlet piping pitched down toward drain trap a minimum of 1%, and connect to floor drain outlet pipe below the floor. Connections to the drain body with-in the concrete floor slab is not permitted.

G. Trap Primer System: Install trap primer line from the trap primer system to the FD with outlet piping pitched down toward drain trap a minimum of 1%, and connect to floor drain outlet pipe below the floor. Connections to the drain body with-in the concrete floor slab is not permitted. Mount enclosure in accessible locations with-in the project area or the mechanical equipment rooms. See drawings for locations. Adjust system for proper flow.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.5 DIELECTRIC CONNECTION INSTALLATION

A. Install dielectric connections when piping of dissimilar metals piping and tubing are joined.

B. Dielectric Connections for NPS 2 and Smaller: Use stainless steel threaded nipples.

C. Dielectric Connections for NPS 2-1/2 and Larger: Use dielectric flange kits.

3.6 VICTAULIC PIPE EXPANSION COMPENSATION INSTALLATION

A. Victaulic – Copper System: Consult Victaulic for the design layout of the expansion loops.

B. Victaulic – Stainless Steel System: Where space permits provide expansion loops. Consult Victaulic for the design layout of the expansion loops. Where space is not adequate for expansion loops install the victaulic expansion joint system.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Division 22 Specification Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Division 22 Specification Section "Hangers and Supports for Plumbing Piping and Equipment."

3.8 CONNECTIONS

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

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

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

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Specification Section "Identification for Plumbing Piping and Equipment."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

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

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 MISCELLANIOUS FITTINGS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

3.13 LEAK TEST PIPING SYSTEMS

A. See Division 22 Specification Section “Leak Test Plumbing Piping Systems” for testing requirements.

END OF SECTION 221100