Sioux Chief Manufacturing prepared the following guidelines to aid design professionals. Incorporate these guidelines into the appropriate project specification Section. Sioux Chief Manufacturing is not liable in any way for revisions or for the use of this Section by any end user. A qualified design professional should review and edit the document to suit project requirements.

Notes are included to assist the design professional in editing the specifications to suit project requirements and are not intended to be included in the final specification. These notes appear in blue text.

For more information or assistance, contact Sioux Chief Manufacturing.

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# SECTION 221116 - DOMESTIC WATER PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

# GENERAL

## RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

## SUMMARY

### Section Includes:

#### Copper tube and fittings.

#### Ductile-iron pipe and fittings.

#### Galvanized steel pipe and fittings.

#### Stainless steel piping

#### CPVC piping.

#### PEX tube and fittings.

#### PEX-AL-PEX tube and fittings.

#### PEX-AL-HDPE tube and fittings.

#### PVC pipe and fittings.

#### PP pipe and fittings.

#### Piping joining materials.

#### Encasement for piping.

#### Transition fittings.

#### Dielectric fittings.

## Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

### Section 221113 "Facility Water Distribution Piping" for water-service piping [and water meters] outside the building from source to the point where water-service piping enters the building.

## ACTION SUBMITTALS

### Product Data: For transition fittings and dielectric fittings.

### Sustainable Design Submittals:

"Product Data" Subparagraph below applies to LEED 2009 NC, CI, and CS; LEED v4; IgCC; and Green Globes. Coordinate with requirements for adhesives.

#### Product Data: For adhesives, indicating VOC content.

"Laboratory Test Reports" Subparagraph below applies to LEED 2009 for Schools, LEED v4, IgCC, and Green Globes. Coordinate with requirements for adhesives.

#### Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

## INFORMATIONAL SUBMITTALS

### System purging and disinfecting activities report.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

### Field quality-control reports.

## FIELD CONDITIONS

Retain this article if interruption of existing water service is required.

### 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 in accordance with requirements indicated:

#### Notify [Architect] [Construction Manager] [Owner] no fewer than [two] <Insert number> days in advance of proposed interruption of water service.

#### Do not interrupt water service without [Architect's] [Construction Manager's] [Owner's] written permission.

# PRODUCTS

For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

## PIPING MATERIALS

See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to revise this Section. See "Piping Materials and Standards" Article in the Evaluations for a discussion of piping materials covered by referenced standards.

### Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. [ Include marking "NSF-pw" on piping.]

## COPPER TUBE AND FITTINGS

Tube in "Hard Copper Tube" Paragraph below is available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

### Hard Copper Tube: [ASTM B88, Type L (ASTM B88M, Type B)] [and] [ASTM B88, Type M (ASTM B88M, Type C)] water tube, drawn temper.

Tube in "Soft Copper Tube" Paragraph below is available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

### Soft Copper Tube: [ASTM B88, Type K (ASTM B88M, Type A)] [and] [ASTM B88, Type L (ASTM B88M, Type B)] water tube, annealed temper.

Fittings in "Cast-Copper, Solder-Joint Fittings" Paragraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

### Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

Fittings in "Wrought-Copper, Solder-Joint Fittings" Paragraph below are available in NPS 1/4 to NPS 8 (DN 8 to DN 200).

### Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

Flanges in "Bronze Flanges" Paragraph below are available in NPS 1/2 to NPS 12 (DN 15 to DN 300).

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

Unions in "Copper Unions" Paragraph below are available in NPS 1/4 to NPS 4 (DN 8 to DN 100).

### Copper Unions:

#### MSS SP-123.

#### Cast-copper-alloy, hexagonal-stock body.

#### Ball-and-socket, metal-to-metal seating surfaces.

#### Solder-joint or threaded ends.

Fittings in "Copper, Brass, or Bronze Pressure-Seal-Joint Fittings" Paragraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

### Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Fittings: Cast-brass, cast-bronze or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 (DN 65) and larger with stainless steel grip ring and EPDM O-ring seal.

#### Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).

Fittings in "Copper Push-on-Joint Fittings" Paragraph below are available in NPS 1/2 to NPS 2 (DN 15 to DN 50).

### Copper Push-on-Joint Fittings:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Description:

##### Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

##### Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

Connections in "Copper-Tube, Extruded-Tee Connections" Paragraph below can be used instead of tee fittings in copper tubing; delete below if prohibited.

### Copper-Tube, Extruded-Tee Connections:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Description: Tee formed in copper tube in accordance with ASTM F2014.

Fittings and couplings in "Appurtenances for Grooved-End Copper Tubing" Paragraph below are available in NPS 2 to NPS 8 (DN 50 to DN 200).

### Appurtenances for Grooved-End Copper Tubing:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Bronze Fittings for Grooved-End, Copper Tubing: ASTM B75/B75M copper tube or ASTM B584 bronze castings.

AWWA C606 does not cover couplings in "Mechanical Couplings for Grooved-End Copper Tubing" Subparagraph below. At least three listed manufacturers make this type of coupling with dimensions for copper tube and fittings. Another manufacturer has a system for expanding the ends of copper tube and fittings so couplings for steel piping may be used.

#### Mechanical Couplings for Grooved-End Copper Tubing:

##### Copper-tube dimensions and design similar to AWWA C606.

##### Ferrous housing sections.

##### EPDM-rubber gaskets suitable for hot and cold water.

##### Bolts and nuts.

##### Minimum Pressure Rating: 300 psig (2070 kPa).

## DUCTILE-IRON PIPE AND FITTINGS

Pipe in "Mechanical-Joint, Ductile-Iron Pipe" Paragraph below is available in NPS 3 to NPS 64 (DN 80 to DN 1600).

### Mechanical-Joint, Ductile-Iron Pipe:

#### AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

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

Fittings in "Standard-Pattern, Mechanical-Joint Fittings" Paragraph below are available in NPS 3 to NPS 48 (DN 80 to DN 1200).

### Standard-Pattern, Mechanical-Joint Fittings:

#### AWWA C110/A21.10, ductile or gray iron.

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

Fittings in "Compact-Pattern, Mechanical-Joint Fittings" Paragraph below are available in NPS 3 to NPS 24 (DN 80 to DN 600).

### Compact-Pattern, Mechanical-Joint Fittings:

#### AWWA C153/A21.53, ductile iron.

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

Pipe in "Push-on-Joint, Ductile-Iron Pipe" Paragraph below is available in NPS 3 to NPS 64 (DN 80 to DN 1600).

### Push-on-Joint, Ductile-Iron Pipe:

#### AWWA C151/A21.51.

#### Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

Fittings in "Standard-Pattern, Push-on-Joint Fittings" Paragraph below are available in NPS 3 to NPS 48 (DN 80 to DN 1200).

### Standard-Pattern, Push-on-Joint Fittings:

#### AWWA C110/A21.10, ductile or gray iron.

#### Gaskets: AWWA C111/A21.11, rubber.

Fittings in "Compact-Pattern, Push-on-Joint Fittings" Paragraph below are available in NPS 3 to NPS 24 (DN 80 to DN 600).

### Compact-Pattern, Push-on-Joint Fittings:

#### AWWA C153/A21.53, ductile iron.

#### Gaskets: AWWA C111/A21.11, rubber.

Pipe in "Plain-End, Ductile-Iron Pipe" Paragraph below is available in NPS 3 to NPS 64 (DN 80 to DN 1600).

### Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

Fittings and couplings in "Appurtenances for Grooved-End, Ductile-Iron Pipe" Paragraph are available in NPS 4 to at least NPS 24 (DN 100 to DN 600).

### Appurtenances for Grooved-End, Ductile-Iron Pipe:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.

Couplings in "Mechanical Couplings for Grooved-End, Ductile-Iron-Piping" Subparagraph below are available in NPS 4 to NPS 24 (DN 100 to DN 600). Other AWWA pipe size couplings in NPS 3 to NPS 36 (DN 80 to DN 900) are also available.

#### Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

##### AWWA C606 for ductile-iron-pipe dimensions.

##### Ferrous housing sections.

##### EPDM-rubber gaskets suitable for hot and cold water.

##### Bolts and nuts.

##### Minimum Pressure Rating:

###### NPS 14 to NPS 18 (DN 350 to DN 450): [250 psig (1725 kPa)] <Insert value>.

###### NPS 20 to NPS 46 (DN 500 to DN 900): [150 psig (1035 kPa)] <Insert value>.

## GALVANIZED-STEEL PIPE AND FITTINGS

Galvanized-steel pipe and fittings corrode over time. They rust from the inside out. Galvanized-steel pipes can corrode to the point where the pipes are completely restricted. Corrosion also occurs in steel that is connected directly to copper or brass.

Pipe in "Galvanized-Steel Pipe" Paragraph below is available in NPS 1/8 to NPS 26 (DN 6 to DN 650).

### Galvanized-Steel Pipe:

#### ASTM A53/A53M, [Type E] <Insert type>, [Grade B] <Insert grade>, Standard Weight.

#### Include ends matching joining method.

Nipples in "Galvanized-Steel Pipe Nipples" Paragraph below are available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

### Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.

Fittings in "Galvanized, Gray-Iron Threaded Fittings" Paragraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

### Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

Unions in "Malleable-Iron Unions" Paragraph below are available in NPS 1/8 to NPS 4 (DN 6 to DN 100).

### Malleable-Iron Unions:

#### ASME B16.39, Class 150.

#### Hexagonal-stock body.

#### Ball-and-socket, metal-to-metal, bronze seating surface.

#### Threaded ends.

Flanges in "Flanges" Paragraph below are available in NPS 1 to NPS 96 (DN 25 to DN 2400).

### Flanges: ASME B16.1, Class 125, cast iron.

### Appurtenances for Grooved-End, Galvanized-Steel Pipe:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.

AWWA C606 covers couplings in NPS 3/4 to NPS 24 (DN 20 to DN 600) in "Fittings for Grooved-End, Galvanized-Steel Pipe" Subparagraph below.

#### Fittings for Grooved-End, Galvanized-Steel Pipe:

##### AWWA C606 for steel-pipe dimensions.

##### Ferrous housing sections.

##### EPDM-rubber gaskets suitable for hot and cold water.

##### Bolts and nuts.

##### Minimum Pressure Rating:

###### NPS 8 (DN 200) and Smaller: [600 psig (4137 kPa)] <Insert value>.

###### NPS 10 and NPS 12 (DN 250 to DN 300): [400 psig (2758 kPa)] <Insert value>.

###### NPS 14 to NPS 24 (DN 350 to DN 600): [250 psig (1725 kPa)] <Insert value>.

## STAINLESS STEEL PIPING

### Potable-water piping and components shall comply with NSF 61 Annex G.

Pipe in "Stainless Steel Pipe" Paragraph below is available in NPS 1/8 to NPS 30 (DN 6 to DN 750).

### Stainless Steel Pipe: ASTM A312/A312M, [Schedule 10] [and] [Schedule 40].

### Stainless Steel Pipe Fittings: ASTM A815/A815M.

Fittings and couplings in "Appurtenances for Grooved-End, Stainless Steel Pipe" Paragraph below is available in NPS 1 to NPS 24 (DN 25 to DN 600).

### Appurtenances for Grooved-End, Stainless Steel Pipe:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Fittings for Grooved-End, Stainless Steel Pipe: Stainless steel casting with dimensions matching stainless steel pipe.

AWWA C606 covers couplings in NPS 3/4 to NPS 24 (DN 20 to DN 600) in "Mechanical Couplings for Grooved-End, Stainless Steel Pipe" Subparagraph below.

#### Mechanical Couplings for Grooved-End, Stainless Steel Pipe:

##### AWWA C606 for stainless steel-pipe dimensions.

##### Stainless steel housing sections.

##### Stainless steel bolts and nuts.

##### EPDM-rubber gaskets suitable for hot and cold water.

##### Minimum Pressure Rating:

###### NPS 8 (DN 200) and Smaller: [600 psig (4137 kPa)] <Insert value>.

###### NPS 10 and NPS 12 (DN 250 to DN 300): [400 psig (2758 kPa)] <Insert value>.

###### NPS 14 to NPS 24 (DN 350 to DN 600): [250 psig (1725 kPa)] <Insert value>.

## CPVC PIPING

Retain "CPVC Pipe," "CPVC Piping System," or "CPVC Tubing System" Paragraph below.

Pipe in "CPVC Pipe" Paragraph below is available in NPS 1/4 to NPS 16 (DN 8 to DN 400).

### CPVC Pipe: ASTM F441/F441M, [Schedule 40] [and] [Schedule 80].

Fittings in "CPVC Socket Fittings" Subparagraph below are available in NPS 1/4 to NPS 6 (DN 8 to DN 150).

### CPVC Socket Fittings: [ASTM F438 for Schedule 40] [and] [ASTM F439 for Schedule 80].

Fittings in "CPVC Threaded Fittings" Subparagraph below are available in NPS 1/4 to NPS 6 (DN 8 to DN 150).

### CPVC Threaded Fittings: ASTM F437, Schedule 80.

Piping in "CPVC Piping System" Paragraph below is available in NPS 1-1/2 and NPS 2 (DN 40 and DN 50).

### CPVC Piping System: ASTM D2846/D2846M, SDR 11, pipe and socket fittings.

Tubing in "CPVC Tubing System" Paragraph below is available in NPS 1/4 to NPS 2 (DN 8 to DN 50).

### CPVC Tubing System: ASTM D2846/D2846M, SDR 11, tube and socket fittings.

## PEX TUBE AND FITTINGS

Tubing in this article is available in NPS 1/8 to NPS 6 (DN 6 to DN 150). The Section Text limits PEX tubing to NPS 1 (DN 25) for use with metal fittings specified.

Retain "Manufacturers" Paragraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing:

#### Substitutions: [Under provisions of Division 01.] [Not permitted.]

### Tube Material: PEX plastic in accordance with ASTM F876 [and ASTM F877].

Retain one of two "Fittings" paragraphs below, or both. If retaining both, indicate where fittings are used in "Joint Construction" and "Piping Schedule" articles. Fittings below are generally available in NPS 3/8 to NPS 1 (DN 10 to DN 25).

### Fittings: [ASTM F1807, metal insert and copper crimp rings] [ASTM F1960, cold expansion fittings and reinforcing rings].

### Fittings: ASSE 1061, push-fit fittings.

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing:

#### Substitutions: [Under provisions of Division 01.] [Not permitted.]

### Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F876; with plastic or corrosion-resistant-metal valve for each outlet.

## PEX-AL-PEX TUBE AND FITTINGS

Tubing in this article is available in NPS 1/2 to NPS 1 (DN 50 to DN 100)

Retain "Manufacturers" Paragraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

#### Substitutions: [Under provisions of Division 01.] [Not permitted.]

### Tube Material: PEX plastic bonded to the inside and outside of a welded aluminum tube in accordance with ASTM F1281.

See discussion in the Evaluations about oxygen barrier in "Oxygen Barrier" Paragraph below. The referenced standard is the only standard used by plastic-tubing manufacturers that describes how to test and measure oxygen diffusion in plastic tube. It is a German national standard and is available in English; see the Evaluations for information about where it can be obtained.

### Oxygen Barrier: Limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) in accordance with DIN 4726.

### Fittings: ASTM F1974, metal insert fittings with split ring and compression nut (compression joint) or metal insert fittings with copper crimp rings (crimp joint).

## PEX-AL-HDPE TUBE AND FITTINGS

Retain "Manufacturers" Paragraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

#### Substitutions: [Under provisions of Division 01.] [Not permitted.]

### Tube Material: ASTM F1986 tubing.

### Fittings for PEX-AL-HDPE Tube: ASTM F1986, metal-insert type with copper or stainless-steel crimp ring and matching PEX-AL-HDPE tube dimensions.

## PVC PIPE AND FITTINGS

Pipe in this article is available in NPS 1/8 to NPS 24 (DN 6 to DN 600).

### PVC Pipe: ASTM D1785, [Schedule 40] [and] [Schedule 80].

Fittings in "PVC Socket Fittings" Paragraph below are available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

### PVC Socket Fittings: [ASTM D2466 for Schedule 40] [and ASTM D2467 for Schedule 80].

Fittings in "PVC Schedule 80 Threaded Fittings" Paragraph below are available in NPS 1/8 to NPS 6 (DN 6 to DN 150).

### PVC Schedule 80 Threaded Fittings: ASTM D2464.

## PP PIPE AND FITTINGS

Pipe in this article is available in NPS 1/2 to NPS 10 (DN 15 to DN 250).

### PP Pipe: ASTM F2389, [SDR 7.4] [and] [SDR 11].

Fittings in "PVC Socket Fittings" Paragraph below are available in NPS 1/2 to NPS 10 (DN 15 to DN 250).

### PVC Socket Fittings: ASTM F2389.

## PIPING JOINING MATERIALS

### Pipe-Flange Gasket Materials:

#### AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.

#### Full-face or ring type unless otherwise indicated.

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

### Solder Filler Metals: ASTM B32, lead-free alloys.

### Flux: ASTM B813, water flushable.

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

### Solvent Cements and Primers for Joining CPVC Piping and Tubing: ASTM F493.

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

#### Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Cement Properties:

##### Viscosity: [Medium] [Heavy duty].

##### Size: [16 oz (473 mL)] [32 oz (946 mL)] [128 oz (3785 mL)].

##### Type: [Hot cement - orange only] [UV indicator - yellow only].

##### Grade: [Industrial] [Regular].

#### Primer Properties:

##### Color: [Purple] [Clear].

##### Size: [16 oz (473 mL)] [32 oz (946 mL)] [128 oz (3785 mL)].

##### Type: NSF listed.

##### Grade: Industrial.

Subparagraph below applies to LEED 2009 NC, CI, and CS; LEED v4; IgCC; and Green Globes. VOC content limit is that for CPVC welding compounds.

#### Solvent cement shall have a VOC content of 490 g/L or less.

Subparagraph below applies to LEED 2009 for Schools Credit IEQ 4.1.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to LEED v4.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to IgCC.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

Subparagraph below applies to Green Globes.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

### Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

#### Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Cement Properties:

##### Color: [Gray] [Clear] [White].

##### Viscosity: [Heavy duty] [Extra heavy duty – gray only].

##### Size: [16 oz (473 mL)] [32 oz (946 mL)] [128 oz (3785 mL)].

##### Type: [Fast set] [Medium set].

#### Primer Properties:

##### Color: [Purple] [Clear].

##### Size: [16 oz (473 mL)] [32 oz (946 mL)] [128 oz (3785 mL)].

##### Type: NSF listed.

##### Grade: Industrial.

Subparagraph below applies to LEED 2009 NC, CI, and CS; LEED v4; IgCC; and Green Globes. VOC content limit is that for PVC welding compounds.

#### Solvent cement shall have a VOC content of 510 g/L or less.

Subparagraph below applies to LEED 2009 NC, CI, and CS; LEED v4; IgCC; and Green Globes. VOC content limit is that for adhesive primers for plastic.

#### Adhesive primer shall have a VOC content of 550 g/L or less.

Subparagraph below applies to LEED 2009 for Schools Credit IEQ 4.1.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to LEED v4.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to IgCC.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

Subparagraph below applies to Green Globes.

#### Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

Subparagraph below applies to LEED 2009 for Schools Credit IEQ 4.1.

#### Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to LEED v4.

#### Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Subparagraph below applies to IgCC.

#### Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

Subparagraph below applies to Green Globes.

#### Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

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

## ENCASEMENT FOR PIPING

### Standard: ASTM A674 or AWWA C105/A21.5.

### Form: [Sheet] [or] [tube].

### Color: [Black] [or] [natural] <Insert color>.

## TRANSITION FITTINGS

### General Requirements:

#### Same size as pipes to be joined.

#### Pressure rating at least equal to pipes to be joined.

#### End connections compatible with pipes to be joined.

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

Couplings in "Sleeve-Type Transition Coupling" Paragraph below are available in NPS 1/2 to NPS 144 (DN 15 to DN 3600).

### Sleeve-Type Transition Coupling: AWWA C219.

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Fittings in "Plastic-to-Metal Transition Fittings" Paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

### Plastic-to-Metal Transition Fittings:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing:

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Description:

##### [CPVC] [or] [PVC] one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

##### One end with threaded brass inserts and one solvent-cement-socket [or threaded] end.

Unions in "Plastic-to-Metal Transition Unions" Paragraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

### Plastic-to-Metal Transition Unions:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing:

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Description:

##### [CPVC] [or] [PVC] four-part union.

##### Brass [ or stainless steel] threaded end.

##### Solvent-cement-joint [ or threaded] plastic end.

##### Rubber O-ring.

##### Union nut.

## DIELECTRIC FITTINGS

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

Unions in "Dielectric Unions" Paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

### Dielectric Unions:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing:

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Standard: ASSE 1079.

Revise pressure rating and temperature in "Pressure Rating" Subparagraph below to suit Project, or insert other options for specific applications.

#### Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [250 psig (1725 kPa)] <Insert value>.

#### End Connections: Solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric Flanges" Paragraph below are available in at least NPS 1-1/2 to NPS 4 (DN 40 to DN 100).

### Dielectric Flanges:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Standard: ASSE 1079.

#### Factory-fabricated, bolted, companion-flange assembly.

Revise pressure rating in "Pressure Rating" Subparagraph below to suit Project or insert other options for specific applications.

#### Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [175 psig (1200 kPa)] [300 psig (2070 kPa)] <Insert value>.

#### End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric-Flange Insulating Kits" Paragraph below are available in at least NPS 1/2 to NPS 48 (DN 15 to DN 1200).

### Dielectric-Flange Insulating Kits:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by <Insert manufacturer's name>.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Nonconducting materials for field assembly of companion flanges.

Revise pressure rating in "Pressure Rating" Subparagraph below to suit Project, or insert other options for specific applications.

#### Pressure Rating: [150 psig (1035 kPa)] <Insert value>.

#### Gasket: Neoprene or phenolic.

#### Bolt Sleeves: Phenolic or polyethylene.

#### Washers: Phenolic with steel backing washers.

Nipples in "Dielectric Nipples" Paragraph below are available in at least NPS 1/2 to NPS 4 (DN 15 to DN 100).

### Dielectric Nipples:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

#### Manufacturers: Subject to compliance with requirements, provide products by Sioux Chief Manufacturing.

##### Substitutions: [Under provisions of Division 01.] [Not permitted.]

#### Standard: IAPMO PS 66.

#### Electroplated steel nipple complying with ASTM F1545.

#### Revise pressure rating and temperature in "Pressure Rating and Temperature" Subparagraph below to suit Project or insert other options for specific applications.

#### Pressure Rating and Temperature: [300 psig (2070 kPa) at 225 deg F (107 deg C)] <Insert values>.

#### End Connections: Male threaded or grooved.

#### Lining: Inert and noncorrosive, propylene.

# EXECUTION

## EARTHWORK

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

## PIPING INSTALLATION

See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to revise this Section.

Coordinate piping installations and specialty arrangements with schematics on Drawings. If Drawings are explicit enough, these requirements may be reduced or omitted.

### Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

### Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

### Install ductile-iron piping under building slab with restrained joints in accordance with AWWA C600 and AWWA M41.

### Install underground [copper tube] [and] [ductile-iron pipe] in PE encasement in accordance with ASTM A674 or AWWA C105/A21.5.

### Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gauges in Section 220519 "Meters and Gauges for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

### Install shutoff valve immediately upstream of each dielectric fitting.

Retain first paragraph below if booster pumps are not required.

### Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

### Install domestic water piping level [with 0.25 percent slope downward toward drain] [without pitch] and plumb.

Retain first paragraph below if water meters are inside the building.

### Rough-in domestic water piping for water-meter installation in accordance with utility company's requirements.

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

### Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

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

### 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.

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

### Install piping to permit valve servicing.

### 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.

### Install piping free of sags and bends.

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

### Install PEX tubing with loop at each change of direction of more than 90 degrees.

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

### Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

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

### Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

### Install thermometers on[ inlet and] outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gauges for Plumbing Piping."

### Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

### Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

### Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

## JOINT CONSTRUCTION

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

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

### Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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:

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

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

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

### Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

### Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

### Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gauge. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

### Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. 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.

### Joint Construction for Grooved-End Copper Tubing: Make joints in accordance with AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

### Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints in accordance with AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

### Joint Construction for Grooved-End Steel Piping: Make joints in accordance with AWWA C606. [Square cut] [Roll] groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

### 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 in accordance with ASME B31.9.

### Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

#### Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

#### CPVC Piping: Join in accordance with ASTM D2846/D2846M Appendix.

#### PVC Piping: Join in accordance with ASTM D2855.

Retain one of two "Joints for PEX Tubing" paragraphs below, or both. If retaining both, indicate where each type shall be used in "Piping Schedule" Article.

### Joints for PEX Tubing: Join in accordance with ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.

### Joints for PEX Tubing: Join in accordance with ASSE 1061 for push-fit fittings.

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

## TRANSITION FITTING INSTALLATION

### Install transition couplings at joints of dissimilar piping.

### Transition Fittings in Underground Domestic Water Piping:

#### Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.

#### Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

### Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition [fittings] [or] [unions].

## DIELECTRIC FITTING INSTALLATION

### Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

### Dielectric Fittings for [NPS 2 (DN 50)] <Insert pipe size> and Smaller: Use dielectric [couplings] [couplings or nipples] [nipples] [unions].

### Dielectric Fittings for [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <Insert pipe size range>: Use dielectric [flanges] [flange kits] [nipples].

### Dielectric Fittings for [NPS 5 (DN 125)] <Insert pipe size> and Larger: Use dielectric flange kits.

## INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below for projects in areas that require seismic restraints.

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

### Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

#### Vertical Piping: MSS Type 8 or 42, clamps.

#### Individual, Straight, Horizontal Piping Runs:

##### 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

##### Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.

##### Longer Than 100 . (30 m) if Indicated: MSS Type 49, spring cushion rolls.

#### Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

#### Base of Vertical Piping: MSS Type 52, spring hangers.

### Install hangers for [copper] [ductile iron] [galvanized steel] [and] [stainless steel] [tubing] [and] [piping], with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### Install vinyl-coated hangers for [CPVC] [PVC] [and] [PP] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### Support horizontal piping within [12 inches (300 mm)] <Insert dimension> of each fitting.

### Support vertical runs of [copper] [ductile iron] [galvanized steel] [and] [stainless steel] [tubing] [and] [piping] to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### Support vertical runs of [CPVC] [PVC] [and] [PP] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

## CONNECTIONS

### Coordinate piping installations and specialty arrangements with schematics on Drawings. If Drawings are explicit enough, these requirements may be reduced or omitted.

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

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

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

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

#### Domestic Water Booster Pumps: Cold-water suction and discharge piping.

#### Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

#### Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

#### Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

## IDENTIFICATION

### Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

### Label pressure piping with system operating pressure.

## FIELD QUALITY CONTROL

Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

### Perform the following tests and inspections:

Portions of testing and inspecting requirements in this article are taken from model plumbing codes. Verify requirements are applicable to location of this Project.

#### Piping Inspections:

##### Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

##### 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:

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

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

#### Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

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

#### Piping Tests:

##### Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

##### Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

##### 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.

##### Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

##### Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

##### Prepare reports for tests and for corrective action required.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

### Domestic water piping will be considered defective if it does not pass tests and inspections.

### Prepare test and inspection reports.

## ADJUSTING

### Perform the following adjustments before operation:

#### Close drain valves, hydrants, and hose bibbs.

#### Open shutoff valves to fully open position.

#### Open throttling valves to proper setting.

#### Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

##### Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

##### Adjust calibrated balancing valves to flows indicated.

#### Remove plugs used during testing of piping and for temporary sealing of piping during installation.

#### Remove and clean strainer screens. Close drain valves and replace drain plugs.

#### Remove filter cartridges from housings and verify that cartridges are as specified for application were used and are clean and ready for use.

#### Check plumbing specialties and verify proper settings, adjustments, and operation.

## CLEANING

Portions of disinfecting requirements in this article are taken from model plumbing codes; revise if requirements vary by authorities having jurisdiction.

### Clean and disinfect potable domestic water piping as follows:

#### Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

#### Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

##### Flush piping system with clean, potable water until dirty water does not appear at outlets.

##### Fill and isolate system in accordance with either of the following:

###### Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.

###### Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

##### Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

##### Repeat procedures if biological examination shows contamination.

##### Submit water samples in sterile bottles to authorities having jurisdiction.

Retain first paragraph below if disinfection of non-potable domestic water piping is required by authorities having jurisdiction.

### Clean non-potable domestic water piping as follows:

#### Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

#### Use purging procedures prescribed by authorities having jurisdiction or if methods are not prescribed, follow procedures described below:

##### Flush piping system with clean, potable water until dirty water does not appear at outlets.

##### Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

#### Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

#### Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

## PIPING SCHEDULE

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

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

Retain "Fitting Option" Paragraph below unless prohibited by authorities having jurisdiction.

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

This article is organized to first present the service and pipe size or size range; then to present optional piping materials and joining methods. Retain the services and sizes and size ranges applicable to Project; then retain the selected piping materials and joining methods. Coordinate selection of piping materials and joining methods with piping materials described in Part 2.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained. Piping for this application matches exterior underground water-service piping specified in Section 221113 "Facility Water Distribution Piping."

### Under-building-slab, domestic water, building-service piping, [NPS 3 (DN 80) and smaller] <Insert pipe size range>, shall be [ one of] the following:

#### Soft copper tube, [ASTM B88, Type K (ASTM B88M, Type A)] [ASTM B88, Type L (ASTM B88M, Type B)]; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal fittings; and pressure-sealed] joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained. Piping for this application matches exterior underground water-service piping specified in Section 221113 "Facility Water Distribution Piping."

### Under-building-slab, domestic water, building-service piping, [NPS 4 to NPS 8 (DN 100 to DN 200) and larger] <Insert pipe size range>, shall be [ one of] the following:

#### Soft copper tube, [ASTM B88, Type K (ASTM B88M, Type A)] [ASTM B88, Type L (ASTM B88M, Type B)]; wrought-copper, solder-joint fittings; and brazed joints.

Caution: Ductile-iron piping in first two subparagraphs below must be installed with restrained joints.

#### Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.

#### Push-on-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, push-on-joint fittings; and gasketed joints.

#### Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained. Piping for this application matches exterior underground combined water-service and fire-service-main piping specified in Section 221113 "Facility Water Distribution Piping."

### Under-building-slab, combined domestic water, building-service, and fire-service-main piping, [NPS 6 to NPS 12 (DN 150 to DN 300)] <Insert pipe size range>, shall be [ one of] the following:

Caution: Ductile-iron piping in first two subparagraphs below must be installed with restrained joints.

#### Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.

#### Push-on-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, push-on-joint fittings; and gasketed joints.

#### Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

### Under-building-slab, domestic water piping, [NPS 2 (DN 50) and smaller] <Insert pipe size range>, shall be [ one of] the following:

#### [Hard] [or] [soft] copper tube, ASTM B88, Type L (ASTM B88M, Type B); [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal-joint fittings; and pressure-sealed] joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

### Aboveground domestic water piping, [NPS 2 (DN 50) and smaller] <Insert pipe size range>, shall be [ one of] the following:

#### Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [ASTM B88, Type M (ASTM B88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [or] [ASTM B88, Type M (ASTM B88M, Type C)]; copper pressure-seal-joint fittings; and pressure-sealed joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [or] [ASTM B88, Type M (ASTM B88M, Type C)]; copper push-on-joint fittings; and push-on joints.

#### CPVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

#### CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.[ NPS 1-1/2 (DN 40) and NPS 2 (DN 50) CPVC pipe with CPVC socket fittings may be used instead of tubing.]

Tubing in first three subparagraphs below is available only in NPS 1 (DN 25) and smaller.

#### PEX tube, NPS 1 (DN 25) and smaller.

##### Fittings for PEX tube:

###### ASTM F1807, metal insert and copper crimp rings.

###### ASTM F1960, cold expansion fittings and reinforcing rings.

###### ASSE 1061, push-fit fittings.

#### PE-AL-PE tube, NPS 1 (DN 25) and smaller; fittings for PE-AL-PE tube; and crimped joints

#### PEX-AL-PEX tube, NPS 1 (DN 25) and smaller; fittings for PEX-AL-PEX tube; and crimped joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

### Aboveground domestic water piping, [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <Insert pipe size range>, shall be [ one of] the following:

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [ASTM B88, Type M (ASTM B88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [or] [ASTM B88, Type M (ASTM B88M, Type C)]; copper pressure-seal-joint fittings; and pressure-sealed joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [or] [ASTM B88, Type M (ASTM B88M, Type C)]; grooved-joint, copper-tube appurtenances; and grooved joints.

#### Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

#### Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

#### CPVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

### Aboveground domestic water piping, [NPS 5 to NPS 8 (DN 125 to DN 200)] <Insert pipe size range>, shall be [ one of] the following:

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [ASTM B88, Type M (ASTM B88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

#### Hard copper tube, [ASTM B88, Type L (ASTM B88M, Type B)] [or] [ASTM B88, Type M (ASTM B88M, Type C)]; grooved-joint, copper-tube appurtenances; and grooved joints.

#### Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

#### Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

#### Stainless steel [Schedule 10] [Schedule 40] pipe, grooved-joint fittings, and grooved joints.

Schedule 40 pipe fittings in first subparagraph below are available only in NPS 6 (DN 150) and smaller.

#### CPVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

#### CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

#### PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

Retain " one of" option in paragraph below to allow Contractor to select piping materials from those retained.

### Aboveground, combined domestic water-service and fire-service-main piping, [NPS 6 to NPS 12 (DN 150 to (DN 300)] <Insert pipe size range>, shall be [ one of] the following:

#### Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

#### Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

#### Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

#### Stainless steel [Schedule 10] [Schedule 40] pipe, grooved-joint fittings, and grooved joints.

## VALVE SCHEDULE

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

#### Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

#### Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

#### Hot-Water Circulation Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.

#### Drain Duty: Hose-end drain valves.

### Use check valves to maintain correct direction of domestic water flow to and from equipment.

### Iron grooved-end valves may be used with grooved-end piping.

# END OF SECTION 221116 - DOMESTIC WATER PIPING