

**SECTION 22 11 00  
FACILITY WATER DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 09 91 00, PAINTING.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, PIPE INSULATION.
- E. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS: Requirements for commissioning, systems readiness checklist, and training.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. All items listed in Part 2 - Products.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  - American Society of Mechanical Engineers (ASME): (Copyrighted Society)
  - A13.1.....Scheme for Identification of Piping Systems
  - B16.3-2011.....Malleable Iron Threaded Fittings Classes 150 and 300
  - B16.9-2007.....Factory-Made Wrought Butt Welding Fittings
  - B16.11-2011.....Forged Fittings, Socket-Welding and Threaded
  - B16.12-2009 .....Cast Iron Threaded Drainage Fittings
  - B16.15-2006 .....Cast Copper Alloy Threaded Fittings Classes 125 and 250
  - B16.18-2001 (R2005).....Cast Copper Alloy Solder-Joint Pressure Fittings

- B16.22-2012.....Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings
- B16.51-2011.....Copper and Copper Alloy Press-Connect Fittings
- NSF/ANSI 61-2012.....Drinking Water System Components - Health  
Effects
- C. American Society for Testing and Materials (ASTM):
- A47/A47M-99(2009).....Ferritic Malleable Iron Castings
- A53/A53M-12.....Pipe, Steel, Black and Hot-Dipped, Zinc Coated  
Welded and Seamless
- A183-03(2009).....Carbon Steel Track Bolts and Nuts
- A269-10.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
- A312/A312M-12.....Seamless, Welded, and Heavily Cold Worked  
Austenitic Stainless Steel Pipes
- A403/A403M-12.....Wrought Austenitic Stainless Steel Piping  
Fittings
- A536-84(2009).....Ductile Iron Castings
- A733-03(2009)e1.....Welded and Seamless Carbon Steel and Austenitic  
Stainless Steel Pipe Nipples
- B32-08.....Solder Metal
- B61-08.....Steam or Valve Bronze Castings
- B62-09.....Composition Bronze or Ounce Metal Castings
- B75/B75M-11.....Seamless Copper Tube
- B88-09.....Seamless Copper Water Tube
- B584-12a.....Copper Alloy Sand Castings for General  
Applications
- B687-99(2011).....Brass, Copper, and Chromium-Plated Pipe Nipples
- D1785-12.....Poly (Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80, and 120
- D2000-12.....Rubber Products in Automotive Applications
- D4101-11.....Propylene Plastic Injection and Extrusion  
Materials
- D2564-04(2009) e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC)  
Plastic Pipe and Fittings
- E1120-08.....Liquid Chlorine
- E1229-08.....Calcium Hypochlorite
- D. American Water Works Association (AWWA):
- C110/A21.10-12.....Ductile Iron and Gray Iron

- C151/A21.51-09.....Ductile-Iron Pipe, Centrifugally Cast
- C153/A21.53-11.....Ductile-Iron Compact Fittings
- C203-08.....Coal-Tar Protective Coatings and Linings for  
Steel Water Pipelines - Enamel and Tape - Hot  
Applied
- C213-07.....Fusion Bonded Epoxy Coating for the Interior &  
Exterior of Steel Water Pipelines
- C651-05.....Disinfecting Water Mains
- E. American Welding Society (AWS):
- A5.8/A5.8M-2011.....Filler Metals for Brazing
- F. American Society of Sanitary Engineers (ASSE):
- ANSI/ASSE 1001-2008.....Pipe Applied Atmospheric Type Vacuum Breakers
- ANSI/ASSE 1010-2004.....Water Hammer Arresters
- ANSI/ASSE 1018-2001.....Trap Seal Primer Valves - Potable Water  
Supplied
- ANSI/ASSE 1020-2004.....Pressure Vacuum Breaker Assembly
- G. International Code Council (ICC)
- ICC IPC (2012).....International Plumbing Code
- H. NSF International (NSF)
- NSF/ANSI 14 (2013).....Plastics Piping System Components and Related  
Materials
- NSF/ANSI 61 (2012).....Drinking Water System Components - Health  
Effects
- NSF/ANSI 372 (2011).....Drinking Water System Components - Lead Content
- I. Plumbing and Drainage Institute (PDI):
- PDI WH-201 2010.....Water Hammer Arrestor

### **1.5 QUALITY ASSURANCE**

- A. A certificate of Welder's certification shall be submitted prior to welding of steel piping. The certificate shall be current and no more than one year old.
- B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.
- C. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

### **1.6 SPARE PARTS**

- A. For mechanical press-connect fittings, provide tools required for each pipe size used at the facility.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372. Endpoint devices used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.
- B. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended.

**2.2 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS**

- A. From inside face of exterior wall to a distance of approximately 5 feet (1500 mm) outside of building and underground inside building, material to be the same for the size specified inside of the building.
- B. Three inches (75 mm) Diameter and Over: Ductile iron, AWWA C151, 125 psi (850 kPa) water steam pressure (WSP), exterior bituminous coating, and cement lined. Provide flanged and anchored connection to interior piping.
- C. Under 3 inch (75 mm) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings as specified under Article 2.2, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.

**2.3 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 6 inches (150 mm) and larger, stainless steel, ASTM A312, schedule 10 shall be used.
- B. Fittings for Copper Tube:
  - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
  - 2. Grooved fittings, 2 to 6 inch (50 to 150 mm) wrought copper ASTM B75 C12200, 5 to 6 inch (125 to 150 mm) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
  - 3. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, 2 inch (50 mm) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer)

non-toxic synthetic rubber sealing elements and un-pressed fitting identification feature.

4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8, Classification BCuP.

G. Re-agent Grade Water Piping and Dialysis Water Piping:

1. Polypropylene, ASTM D4101, Schedule 80 pressure pipe with dimensions in conformance with ASTM D2447, but without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket fusion joints.
2. Polyethylene, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.
3. Reverse Osmosis (RO) Water Piping:

- a. Low Pressure Feed, Reject and Recycle Piping, 75 psi and under:  
ASTM D 1785, Schedule 80 PVC, socket welded and flanged.
- b. RO Product Tubing From Each Membrane Housing: ASTM D1785,  
Schedule 80 PVC, socket welded and flanged.
- c. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
- d. High Pressure Reject and Recycle Piping (above 75 psi): ASTM  
A269, Type 304 schedule 10 stainless steel with butt welded  
joints.
- e. High Pressure Control and Pressure Gage Tubing: 1000 psi burst  
nylon.

#### **2.4 EXPOSED WATER PIPING**

- A. Finished Room: Use full iron pipe size chrome plated brass piping for  
exposed water piping connecting fixtures, casework, cabinets, equipment  
and reagent racks when not concealed by apron including those furnished  
by the Government or specified in other sections.
  - 1. Pipe: Fed. Spec. WW-P-351, standard weight.
  - 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome  
finish.
  - 3. Nipples: ASTM B 687, Chromium-plated.
  - 4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish.  
Unions 2-1/2 inches (65 mm) and larger shall be flange type with  
approved gaskets.

#### **2.5 ETHYLENE OXIDE (ETO) STERILIZER WATER SUPPLY PIPING**

- A. Stainless steel, ASTM A312, Schedule 10 with stainless steel butt  
welded fittings. Provide on sterilizer water supply.

#### **2.6 TRAP PRIMER WATER PIPING:**

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

#### **2.7 STRAINERS**

- A. Provide on high pressure side of pressure reducing valves, on suction  
side of pumps, on inlet side of indicating and control instruments and  
equipment subject to sediment damage and where shown on drawings.  
Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass  
strainer basket.
- C. Body: Smaller than 3 inches (80 mm), brass or bronze; 3 inches (80 mm)  
and larger, cast iron or semi-steel.

**2.8 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

**2.9 STERILIZATION CHEMICALS**

- A. Hypochlorite: ASTM E1120-08
- B. Liquid Chlorine: ASTM E1229-08

**2.10 WATER HAMMER ARRESTER:**

- A. Closed copper tube chamber with permanently sealed 60 psig (410 KpA) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI-WH 201). Provide water hammer arrestors at:
  - 1. All solenoid valves.
  - 2. All groups of two or more flush valves.
  - 3. All quick opening or closing valves.
  - 4. All medical washing equipment.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. General: Comply with the International Plumbing Code and the following:
  - 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
  - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
  - 3. All pipe runs shall be laid out to avoid interference with other work.
  - 4. Install union and shut-off valve on pressure piping at connections to equipment.
  - 5. Pipe Hangers, Supports and Accessories:
    - a. All piping shall be supported per the International Plumbing Code.
    - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red

lead or zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

c. Floor, Wall and Ceiling Plates, Supports, Hangers:

- 1) Solid or split un-plated cast iron.
  - 2) All plates shall be provided with set screws.
  - 3) Pipe Hangers: Height adjustable clevis type.
  - 4) Adjustable Floor Rests and Base Flanges: Steel.
  - 5) Concrete Inserts: "Universal" or continuous slotted type.
  - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
  - 7) Riser Clamps: Malleable iron or steel.
  - 8) Rollers: Cast iron.
  - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
  - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
  - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
  - 12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
- a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke

and gases as specified in Section 07 84 00. Completely fill and seal clearances between raceways and openings with the fire stopping materials.

- b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00.
- 8. Mechanical press-connect fitting connections shall be made in accordance with the manufacturer's installation instructions. Depth of insertion must be marked on the tube prior to inserting the tube into the fitting. Ensure the tube is completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.
- B. Piping shall conform to the following:
  - 1. Domestic Water:
    - a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
    - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

### 3.2 TESTS

- A. General: Test system either in its entirety or in sections. Submit testing plan to Resident Engineer/COR 14 days prior to test date.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 150 psi (1040 kPa) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.

- C. Re-agent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 200 psi (1040 kPa) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

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