

## PART 1 - GENERAL

### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.21.2M	(1983) Roof Drains
ANSI A112.36.2M	(1991; R 1998) Cleanouts
ANSI B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.23	(1992; Errata 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI B16.24	(1991; Errata 1991) Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500, and 2500
ANSI 221.10.1	(1993) Gas Water Heaters Volume I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
ANSI 221.22	(1986) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems

#### AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

AR.I 1010	(1994) Self Contained, Mechanically-Refrigerated Drinking-Water Coolers
-----------	---

#### AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE 90A	(1980; Addendum 1987) Energy Conservation in New Building Design (Section 1 through 3)
------------	--

#### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M	(1997) Floor-Applied Supports for Off-the-Floor Plumbing Fixtures for Public Use.
ASME A112.18.1M	(1996) Plumbing Fixture Fittings
ASME/ANSI A112.19.1M	(1994; Errata 1998) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures

ASME/ANSI A112.19.3M	(1987; R 1996) Stainless Steel Plumbing Fixtures (Designed for Residential Use)
ASME A112.19.5	(1979; R 1998) Trim for Water-Closet Bowls, Tanks, and Urinals
ASME A112.21.1M	(1991; R 1998) Floor Drains
ASME/ANSI B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME/ANSI B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ANSI/ASME B16.29	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ANSI/ASME B16.32	(1992) Cast Copper Alloy Joint Fittings for Solvent Drainage Systems
ASME BPVC SEC IV PT HLW	(1995; Addenda 1995, 1996, and 1997) Boiler and Pressure Vessel Code Section IV Part HLW Potable-Water Heaters

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(1993; Errata 1993) Water Pressure Reducing Valves
ASSE 1019	(1993) Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	(1996) Cast Iron Soil Pipe and Fittings
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM B 32	(1996) Solder Metal
ASTM B 42	(1996) Seamless Copper Pipe, Standard Sizes

ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 306	(1996) Copper Drainage Tube (DWV)
ASTM B 584	(1996) Copper Alloy Sand Castings for General Applications
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2000	(1996) Rubber Products in Automotive Applications
ASTM D 2665	(1997; Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2846/D 2846M	(1997) Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems

#### AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 0651	(1992) Disinfecting Water Mains
-----------	---------------------------------

#### COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-50560,	Pumps, Centrifugal, Water Circulating, Electric-Motor-Driven
----------------	---

#### CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI HSN	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings
CISPI 301	(1995) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1995) Couplings Joint for Use in Connection with Hubless Cast Iron Soil Pipe and Fitting

#### FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	List of Approved Backflow Prevention Assemblies
------------	---

#### INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(1996) International Plumbing Code
---------	------------------------------------

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY, INC. (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71.	(1997) Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1996) National Fuel Gas Code
---------	-------------------------------

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH201	(1992) Water Hammer Arrestors
-----------	-------------------------------

## 1.2 RELATED REQUIREMENTS

Section 15050, "Basic Mechanical Materials and Methods," applies to this section with the additions and modifications specified herein.

## 1.3 SYSTEM DESCRIPTION

Provide new plumbing systems, complete and ready for operation. Plumbing systems including manufacturer's products shall be in accordance with the required and advisory provisions of the ICC IPC. Plumbing systems include piping less than 5 feet outside of building walls and piping beyond 5 feet outside of building walls including connections to existing exterior distribution systems.

## 1.4 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

### 1.4.1 SD-03, Product Data

- a. Pipe and fittings
- b. Valves
- c. Plumbing fixtures

- d. Water heaters
- e. Water Softeners
- f. Pipe hangers and supports
- g. Pumps
- h. Pressure gages
- i. Strainers
- j. Drains
- k. Water hammer Arrestors
- l. Backflow preventers
- m. Electric water coolers
- n. Thermometers
- o. For pumps, include certified pump test curves.

#### 1.4.2 SD-06, Test Reports

- a. Backflow Preventers Test Report

#### 1.4.3 SD-10, Operation and Maintenance Data

- a. Water heaters, Data Package 2
- b. Pumps, Data Package 2
- c. Electric water coolers, Data Package 2
- d. Water Softeners, Data Package 2
- e. RO units, Data Package 2

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data."

### 1.5 QUALITY ASSURANCE

Plumbing systems including fixtures, equipment, materials, installation, and workmanship shall be in accordance with the Plumbing Code except as modified herein. In the Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for the word "should" wherever it appears; reference to the "authority having jurisdiction," the Administrative Authority, the Plumbing Official, and the Design Engineer shall be interpreted to mean the Contracting Officer. Capacity of equipment shall be not less than that indicated.

## PART 2 - PRODUCTS

### 2.1 DRAIN, WASTE, AND VENT (DWV) PIPE AND FITTINGS

Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.

#### 2.1.1 Buried Piping

Provide piping up to but not more than 6 inches aboveground or floor slab on grade.

##### 2.1.1.2 Cast Iron Hub and Spigot Pipe and Fittings

ASTM A 74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

##### 2.1.1.3 Plastic Pipe, Fittings, and Solvent Cement (Outside of Building Foundation Only)

- a. Polyvinyl Chloride (PVC) System: ASTM D 2665.

#### 2.1.2 Aboveground Piping

##### 2.1.2.1 Cast Iron Hubless Pipe and Fittings

CISPI 301 with CISPI 310 couplings.

##### 2.1.2.2 Cast Iron Hub and Spigot Pipe and Fittings

ASTM A '74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

##### 2.1.2.3 Copper Tubing

ASTM B 306, with ANSI B16.23, ANSI/ASME B16.29, or ANSI/ASME B16.32 solder joint fittings using ASTM B 32, 95-5 tin-antimony or Grade Sn96 tin-silver solder, and .flux containing not more than 0.2 percent lead.

##### 2.1.2.4 Grooved-End Steel Piping for Roof Drainage Only

ASTM A 53, Schedule 40, hot-dip galvanized, cut grooved-end steel pipe; ASTM A 47M ASTM A 47 or ASTM A 536, hot-dip galvanized, grooved-end fittings, and mechanical couplings; ASTM A 183 coupling nuts and bolts; ASTM D 2000 rubber gaskets for water service. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

#### 2.1.3 Cleanouts

ANSI A112.36.2M; provide threaded bronze or thermoplastic or PVC plastic cleanout plugs.

##### 2.1.3.1 Floor Cleanouts

Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

### 2.1.3.2 Wall Cleanouts

Provide polished stainless steel or chromium-plated copper alloy cover plate and secure to cleanout plug with countersunk stainless steel screw.

### 2.1.3.3 Cleanouts Exterior to Buildings

Provide cast-iron cleanouts and countersunk plugs. 24 by 24 by 4 inch thick concrete slab with one inch above grade with cleanout located in center of slab.

### 2.1.4 Drains

ASME A112.21.1M; provide cast-iron or ductile-iron drains and clamping rings for use with membrane waterproofing. Provide P-traps for each floor drain.

#### 2.1.4.1 Flush Strainer Floor Drains

Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze, polished stainless steel, or chromium-plated copper alloy strainer, and adjustable collar. Drains of sizes 2, 3, and 4 inches shall have strainers with minimum free drainage area of 5, 11, and 18 square inches, respectively.

#### 2.1.4.2 Roof Drains

ANSI A112.21.2M; provide hot-dip galvanized cast-iron or ductile-iron drains, with minimum of 10 inch diameter body, non-puncturing flashing clamp device with integral gravel stop and deck clamp, and removable cast-iron or ductile-iron or polypropylene locking dome. Free area of dome shall be not less than two times the free area of drain outlet. Provide drain flashing ring seat flush with adjacent roof deck, and secure rigidly in place with deck clamp.

## 2.2 DOMESTIC WATER PIPING

### 2.2.1 Buried Piping and Aboveground Piping

#### 2.2.1.1 Copper Tubing

ASTM B 88M, ASTM B 88, Type L for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME/ANSI B16.22 solder joint fittings; or with ASME/ANSI B16.26 flared joint fittings. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder. Provide copper tubing for pipe sizes 4 inches or smaller.

#### 2.2.2 Water Valves

Provide valves suitable for minimum of 125 psig and minimum of 180 degrees F hot water. Valves shall have flanged end connections, except sizes smaller than 2.5 inches may have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Ball valves may be provided in lieu of gate valves. Provide blue finish and red finish on hand wheels for valves in cold domestic water piping and hot domestic water piping, respectively.

#### 2.2.2.1 Gate Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

#### 2.2.2.2 Globe and Angle Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

#### 2.2.2.3 Check Valves

MSS SP-80, Class 125, swing check.

#### 2.2.2.4 Ball Valves

Full port design, copper alloy, except sizes 2.5 inches and larger shall be ductile-iron body or cast-iron body. Valves shall have two-position lever handles.

#### 2.2.2.5 Hose Bibbs

Provide angle type copper alloy hose bibb with lock shield and removable tee-handle. Inlet shall have internal threads. Outlet shall have vacuum breaker with 0.75 inch external hose threads.

#### 2.2.2.6 Non-freeze Wall Hydrant

ASSE 1019, cast bronze, with removable tee-handle, one inch external thread inlet, 0.75 inch external hose thread outlet with automatic draining vacuum breaker. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building. Bonnet and valve stem shall be removable from outside of the building.

#### 2.2.3 Strainers

Strainers shall have blow off outlet with pipe nipple and gate valve and discharge pipe nipple. Copper alloy or cast-iron body. Provide stainless steel strainer element with perforations of 0.047 inch.

#### 2.2.4 Pressure Gages

Provide single style pressure gage for water with 4.5 inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range suitable for the intended service.

#### 2.2.5 Thermometers

Provide Bimetal dial type thermometers with stainless steel case, stem, and fixed thread connection; 5 inch diameter dial with glass face gasketed within the case; accuracy within 2 percent of scale range. Provide scale range suitable for the intended service.

#### 2.2.6 Dielectric Connections

Provide at connections between copper and ferrous metal piping materials. ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length, may be provided for dielectric connections in pipe sizes 2 inches and smaller.

### 2.2.7 Water Hammer Arrestors

PDI WH201.

### 2.2.8 Valve Boxes

For each buried valve provide cast-iron, ductile-iron, or plastic box of a suitable size. Provide cast-iron, ductile-iron cover for the box with the word "WATER" cast on the cover. Plastic boxes shall be constructed of ABS plastic or inorganic fiber-reinforced black polyolefin plastic. Coat cast-iron and ductile-iron boxes with bituminous paint.

### 2.2.9 Backflow Preventers

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (non-pressure) type vacuum breakers, and pressure type vacuum breakers shall be listed in the current FCCCHR-USC.

## 2.3 MISCELLANEOUS PIPING MATERIALS

### 2.3.1 Flanges

ASME/ANSI B16.1, Class 125, for use in ferrous piping; ASME/ANSI B16.22 or ANSI B16.24 for use in copper tubing; with MIL-R-6855 full face flat type synthetic rubber gaskets.

### 2.3.2 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated or polished stainless steel finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

### 2.3.3 Pipe Sleeves

#### 2.3.3.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A 53, Schedule 40 or Standard Weight, hot-dip galvanized steel, ductile-iron pipe sleeves.

#### 2.3.3.2 Sleeves in Non-Masonry or -Concrete Walls, Floors, and Roofs

Provide 26 gage hot-dip galvanized steel sheet.

#### 2.3.3.3 Pipe Sleeve Provisions

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed .fill, void, or cavity material.

a. Sleeves in masonry and concrete walls, floors, and roofs: Provide steel pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

b. Sleeves in other than masonry and concrete walls, floors, and roofs: Provide 26 gage galvanized steel sheet.

#### 2.3.4 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

#### 2.3.5 Access Doors

Provide 12 by 12 inch factory prefabricated and primed flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in plaster and masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.

### 2.4 FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated per ASME A112.18.1M. Center set faucets shall be top-mounted with inlets on not greater than 4 inch centers. Provide special roughing-in for wheelchair fixtures.

#### 2.4.1 Flush Valve Type Water Closets

ASME A112.19.2M, white vitreous china, wall-hung, siphon jet, elongated bowl, white solid plastic elongated open-front seat, and ASME A112.19.5 trim. Provide large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers) non-hold-open flush valve of chrome plated cast brass, including vacuum breaker and angle (control-stop) valve with back check, mounted approximately 39 to 44 inches above floor. The water flushing volume of the flush valve and water closet combination shall not exceed 1.6 gallons per flush. Provide ASME A112.6.1M carrier with feet.

#### 2.4.2 Wheelchair Water Closets

Provide same as specified for water closets except water closet mounting height to top of seat shall be 17 to 19 inches above floor.

#### 2.4.3 Flush Valve Type Urinals

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, blowout Action, with integral trap, extended side shields, and ASME A112.19.5 trim. Provide large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), non hold-open flush valve of chrome plated cast brass, including vacuum breaker and angle

(control-stop) valve with back check. Water flushing volume of the flush valve and urinal combination shall not exceed one gallon per flush. Provide ASME A112.6.1M concealed chair carriers.

#### 2.4.4 Wheelchair Flush Valve Type Urinals

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, blowout action, integral trap, elongated projecting bowl, 20 inches long from wall to front of flare, and ASME A112.19.5 trim. Provide large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated cast brass conforming to ASTM B 584, including vacuum breaker and angle (control-stop) valve with back check. The water flushing volume of the flush valve and urinal combination shall not exceed 3.8 liters one gallon per flush. Furnish urinal manufacturer's certification of conformance. Provide ASME A112.6.1M concealed chair carriers. Mount urinal with front rim a maximum of 17 inches above floor and flush valve handle a maximum of 44 inches above floor for use by handicapped on wheelchair.

#### 2.4.5 Wheelchair Countertop Lavatories

ASME/ANSI A1.12.19.1M, white enameled cast-iron, or vitreous China minimum oval dimensions of 19 inches wide by 16 inches front to rear, self-rimming type, and meeting ADA access requirements when mounting in 34" high counter top. Provide ASME A112.18.1M copper alloy center set faucets with goose-neck spout with aerator 5 inches above rim, perforated grid strainers with offset tailpiece, and 1.25 inch adjustable P-traps. Flow shall not exceed 1.0 gpm at 80 psi flow pressure. Furnish template and mounting kit by lavatory manufacturer. Provide drain and hot water supply insulation kits to meet ADA requirements.

#### 2.4.6 Countertop Sinks

ASME/ANSI A112.19.3M, 20 gage stainless steel with integral mounting rim, minimum dimensions of 15 inches wide by 15 inches front to rear, single compartment with ledge back and undersides coated with sound dampening material. Provide top-mounted ASME A112.18.1M copper alloy faucets, swing spout with aerator, and stainless steel drain outlets with cup strainers. Flow shall not exceed 1.5 gpm at 80 psi flow pressure. Provide 1.5 inch adjustable P-trap with drain piping to vertical vent stack.

#### 2.4.7 Wheelchair Electric Water Cooler

ARI 1010, two level wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 8.0 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front bottom of unit to floor and 36 inch maximum spout height above floor for handicapped section. Bubblers shall also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of the cabinet.

#### 2.4.8 Stainless Steel Mop Basins

Welded Seamless 16 gauge Stainless steel mop basin, 25"X21"X10" deep designed for corner mounting. Provide floor outlet copper alloy body drains as indicated, with nickel bronze, chromium-plated copper alloy, or polished stainless steel strainers. Provide with two handled wall supported faucet set with vacuum breaker, pail hook and 3/4 inch hose thread outlet. Provide three station mop rack on wall opposite from faucet.

## 2.5 DOMESTIC WATER HEATERS (GAS-FIRED)

ANSI 221.10.1, gas-fired water heaters glass-lined steel tanks, high efficiency type insulated with polyurethane foam insulation, replaceable anodes, with adjustable range thermostat to allow hot water settings between 110 and 140 degrees F. Provide posted operating instructions for water heaters.

### 2.5.1 Gas Vents

NFPA 211, Type B, of the prefabricated multi-wall UL listed type.

### 2.5.2 Gas Piping System

NFPA 54. Provide threaded fittings and end connections.

#### 2.5.2.1 Steel Pipe

ASTM A 53. Schedule 40, Black Steel.

#### 2.5.2.2 Threaded Fittings

ANSI/ASME B16.3, Class 150, Black Steel or cast iron.

#### 2.5.2.3 Gas Valves

Provide cast-iron or bronze body valves, with bronze plug or ball and two position lever handles. Valves shall be suitable for 125 psig working pressure. UL listed ball valves may be provided in lieu of plug valves.

## 2.6 PUMPS

Select the pump so that the operating point on the characteristic performance curve for the impeller size to be furnished will be to the left (shut-off side) of and not more than 5 percent below the point of maximum efficiency for the impeller to be furnished.

### 2.6.1 Inline Water Pumps

CID A-A-50560, standard head capacity, service water distribution system. Provide factory assembled and tested pumps constructed of materials suitable for hot domestic water service.

### 2.6.2 Pressurization Water Pumps

Multi stage centrifugal pumps with stainless steel impellers and construction suitable for use with Reverse Osmosis Water, vertical configuration with mounting base, see schedule for required capacity and horsepower.

### 2.6.3 Domestic Water Softener

Commercial capacity softener consisting of ion exchange resin tank, brine tank, controls, diverting valve and flow controls to limit flow to system capacity.

#### 2.6.4 Softener Tank and Media

Softener tank to be carbon steel tank coated with two part epoxy coating system to prevent corrosion. Tank to be rated for 100 PSIG operating pressure and have openings for top valve mounting and easy opening hand hole for resin inspection and sampling without removal of control valve. Resin for the tank to be of premium materials designed for high exchange rate capacity. Resin media retainage system to be designed so that water contacts all of the media and screens prevent resin carry over to water system of back-flush system.

#### 2.6.5 Brine Tank System

Tank to be atmospheric type constructed of fiberglass, HDPE or PVC resins to withstand brine solution. Provide controls to supply concentrated brine in the correct quantity for resin media re-generation. Include floats or other controls as standard with the manufacturer for complete and operational brine system.

#### 2.6.6 Control System

Control system to consist of discharge water sensor or inlet water meter to initiate start of the regeneration process. Sensor or water meter to be set up to monitor leaving water quality and re-generate system when water hardness exceeds 8 grains of hardness. Unit control valve shall control flow at a constant rate from 30 to 100 PSIG, control normal and bypass operations and brine feed and backwash functions for media regeneration.

#### 2.6.7 System Capacity and Efficiency

Water Softener System to have 100,000 to 150,000 grain removal capacity with 3 to 79 pounds of salt dosage. Flow rate of 15 GPM shall not cause pressure drop over 11 PSIG.

#### 2.6.8 Reverse Osmosis System (RO)

Complete packaged system consisting of separation membrane, pressurization pumps, bleed and controls required for operation.

#### 2.6.9 Membranes

Spiral wound reverse osmosis membranes to reject significant amount of dissolved minerals, as well as colloids, particles, organic materials and silica. Membrane housings to provide positive seal to assure that raw water bypass does not occur.

#### 2.6.10 Pump

RO Pressurization pump shall be multi-stage centrifugal pump, designed to increase pressure as required to pump through the RO membranes and into the storage tank. Design pump based on 45 psig inlet pressure from the chlorine removal filter.

#### 2.6.11 Capacity and Efficiency

RO system to have a nominal capacity of 7500 gallons per day capacity @ 60% recovery capacity. Efficiency may be increased by re-use of waste water shunted to pump inlet if reject water is better quality than entering water.

#### 2.6.12 Controls

Controls to consist of the following or equivalent readouts and safety controls as standard with the manufacturer. Low Pressure Switch, Connection for chlorine sensor to shut down operation, NEMA 4X enclosure, TDS Monitor, Elapsed Time Monitor to determine scheduled maintenance, Visual and Audible alarm for low pressure and poor water quality shut down, Panel Mounted Flow Control Indicators, Concentrate Throttling Valve allows changes in system recovery to suit specific applications, Automatic Low Pressure Flush Feature to extend membrane life.

#### 2.6.13 Chlorine Removal Carbon Filter

Activated Carbon type filters with backwash feature to re-generate media for extended filter life, with corrosion resistant tank, control valve and backwash controls.

#### 2.6.14 Chlorine Removal Media

Activated granular carbon to provide additional filtration and adsorb high and low molecular weight organic compounds. Media to contain screens to retain media during flow and backwash and be resistant to abrasion associated with backwash operations.

#### 2.6.15 Filter Tank

Steel tank with vinyl or polyethylene liner of 20 mill or greater thickness and exterior shrink fit plastic jacket or epoxy paint system. Tank to be rated for continuous operational pressure of 100 PSIG. Tank to be nominal 16”D X 48”H.

#### 2.6.16 Controls and Performance

Provide control valve and optional backwash pressure differential switch to initiate backwash cycle. Backwash flow to be approximately twice the normal adsorption flow rate. Peak flow rate for the filter to be 14 GPM @ 4 PSID and adsorption flow rate to be 7 GPM @ 1 PSID.

#### 2.6.17 Chlorine Sensor

Total Residual Chlorine Analyzer based on test method 408.3 in STANDARD METHODS, for examination of water and waste water.

#### 2.6.18 Range, Repeatability and Accuracy

RANGE: 0-5 Mg/L, REPEATABILITY: +/- .05 Mg/L, ACCURACY: Better than +/- 5% of reading or +/- .05 Mg/L. Accuracy and other functions with swings in pH or Alkalinity levels.

#### 2.6.19 Alarms and Outputs

Two sample concentration alarms, analyzer system warning , and analyzer system shut down alarm. Recorder Output: Provide programmable span and 4-20 Ma output through RS232 computer interface card so alarms and outputs can be transmitted to building automation system. Output to also be capable of closing solenoid valve to stop water flow to RO unit to prevent damage to media.

### 2.6.20 Maintenance Kit

Provide adequate reagent materials, tubing, colorimeter lamp assemblies and other components required for normal annual usage for the sensor system.

### 2.6.21 Power Requirements

Provide power cord with retainer clip and unit designed for 120 V / 60 Hz operation.

### 2.6.22 Hydro-Pneumatic Tank

Provide Hydro-Pneumatic Tank suitable for RO water and potable water applications, and be of factory charged bladder type tank.

### 2.6.23 Capacity and Pressure Rating

Tank shall be ASME Section VIII rated for 125 PSIG working pressure and have 62 gallon total capacity and acceptance volume of 19.2 gallons at operating range of 30 PSIG for pump start and 50 PSIG for pump stop. Pressure switch to control pump shall be integral with tank and mounted on to inlet pipe to Hydro-Pneumatic tank.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

Installation of plumbing systems including fixtures, backflow preventers, equipment, materials, and workmanship shall be in accordance with the Plumbing Code, except as modified herein. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply.

#### 3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PT FE) pipe thread paste, pipe cement and oil, or PT FE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

#### 3.1.2 Solder End Valves

Remove stems and washers and other item subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

#### 3.1.3 Pipe Supports (Hangers)

Provide additional supports at the concentrated loads in piping between supports, such as for inline water pumps and flanged valves. Maximum of 5 foot apart at valves and pumps.

##### 3.1.3.1 Piping to Receive Insulation

Provide temporary wood spacers between the insulation protection shield and the pipe in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation to be provided under Section 15080, "Mechanical Insulation."

### 3.1.3.2 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at each floor, but at not more than 10 foot intervals, with pipe riser clamps or offset pipe clamps

b. Horizontal Piping: Support cast-iron piping at 5 foot intervals, except for pipe exceeding 5 foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. Locate supports within one foot of joints at each change of direction and with 18 inches of joints for straight runs. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	6
Steel Pipe	7	8	9	10	11	12	13	14	16
Copper Tube	6	7	8	8	9	10	11	12	13

### 3.1.4 Ductile Iron Pipe Aboveground

Provide flanged joints.

### 3.1.5 Installation of Pipe Sleeves

Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than one inch space between exterior of piping or pipe insulation and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs 3 inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.

### 3.1.6 Copper Tube Extracted Joint

An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to ensure a free flow joint. Braze extracted joints using a copper phosphorus classification brazing filler metal. Soldered joints shall not be permitted.

## 3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves; stop valves in supplies to fixtures will not require nameplates. Laminated plastic shall be 0.125 inch thick melamine plastic, black with white center core. Surface shall be a matte finish. Corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Lettering shall be minimum of 0.25 inch high normal block lettering. Key nameplates to a chart and

schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information:

- a. Manufacturer, type, and model number
- b. Contract number and accepted date
- c. Capacity or size
- d. System in which installed
- e. System which it controls

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

#### 3.3.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

##### 3.3.2.1 Domestic Water Piping

Before applying insulation, Hydrostatically test each piping system at not less than 100 psig system working pressure with no leakage or reduction in gage pressure for 2 hours.

##### 3.3.2.2 DWV Piping

Before the installation of fixtures, cap ends of each system, fill piping with water to the roof, and allow to stand until a thorough inspection has been made. If the system is tested in sections, each opening shall be plugged and each section tested with not less than 35 foot head of water. After plumbing fixtures have been set and their traps filled with water, subject the entire sanitary system to a final air pressure test of not more than 1.0 inch of water column and a smoke test. Perform the air and smoke test with an approved smoke testing machine which shall show a clear passage of smoke and air throughout the entire system. The entire system shall be proven absolutely tight under such test.

##### 3.3.2.3 Backflow Preventers Test Report

Backflow preventers shall be tested by a locally approved and certified backflow assembly tester. A copy of the test report shall be provided to the Contracting officer prior to placing the domestic water system into operation, or no later than 5 days after the test.

### 3.4 DISINFECTION

Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million (ppm) of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 m/g ppm, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service.

END OF SECTION