

SECTION 15B

PLUMBING, GENERAL PURPOSE

1. APPLICABLE PUBLICATIONS: 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.

1.1 Federal Specifications (Fed. Spec.):

L-C-530B & Am-1 & Int Am-2	Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
W-H-196J & Int Am-1	Heater, Water, Electric, and Gas Fired, Residential
QQ-C-40 & Am-2	Calking: Lead Wool and Lead Pig
QQ-C-576b & Am-1	Copper Flat Products With Slit, Slit and Edge-Rolled, Sheared, Sawed, or Machined Edges, (Plate, Bar, Sheet, and Strip)
TT-C-00598C & Am-1	Calking Compound, Oil and Resin Base Type (for Building Construction)
TT-P-1536A	Plumbing Fixture Setting Compound
WW-N-351C & Int Am-1	Nipples, Pipe, Threaded
WW-P-541D/GEN & Am-1	Plumbing Fixtures (Land Use) (General Specification)
WW-P-541/1A & Am-1	Plumbing Fixtures (Water Closets, Land Use) (Detail Specification)
WW-P-541/2A	Plumbing Fixtures (Urinals, Land Use) (Detail Specification)
WW-P-541/4A	Plumbing Fixtures (Lavatories, Land Use) (Detail Specification)
WW-P-541/5A	Plumbing Fixtures (Sinks, Kitchen and Service and Laundry Tub, Land Use) (Detail Specification)
WW-P-541/6A	Plumbing Fixtures (Drinking Fountains, Land Use) (Detail Specification)
WW-U-516B	Unions, Brass or Bronze, Threaded Pipe Connections, and Solder-Joint Tube Connections

WW-U-531E Unions, Pipe, Steel or Malleable Iron;  
Threaded Connection, 150 Lb and 250 Lb

WW-V-35B Valve, Ball  
& Am-1

1.2 Federal Standard (Fed. Std.):

H28 Screw-Thread Standards for Federal  
& Suppl 1A

1.3 Military Specification (Mil. Spec.):

MIL-T-27730A Tape, Antiseize, Polytetrafluoroethylene,  
with Dispenser

Air Conditioning and Refrigeration Institute (ARI) Standard:

1010-82 Drinking-Fountains and Self-Contained,  
Mechanically-Refrigerated  
Drinking-Water Coolers

American National Standards Institute (ANSI) Standards:

A13.1-1981 Scheme for the Identification of Piping  
Systems

A40.5-1943 Threaded Cast-Iron Pipe for Drainage,  
Vent, and Waste Services

A112.1.2-1973 Air Gaps in Plumbing Systems  
(R 1979)

A112.6.1M-1979 Supports for Off-the-Floor Plumbing  
Fixtures for Public Use

A112.14.1-1975 Backwater Valves

A112.21.1-1968 Floor Drains  
(R 1974)

A112.36.2-1975 Metallic Cleanouts

B2.1-1968 Pipe Threads (Except Dryseal)

B16.3-1977 Malleable Iron Threaded Fittings Class  
150 and 300

B16.4-1977 Cast Iron Threaded Fittings Class 125  
and 250

B16.12-1977 Cast Iron Threaded Drainage Fittings

B16.15-1978 Cast Bronze Threaded Fittings, Class  
125 and 250

B16.18-1978	Cast Copper Alloy Solder-Joint Pressure Fittings
B16.21-1978	Nonmetallic Flat Gaskets for Pipe Flanges
B16.22-1980	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.23-1976	Cast Copper Alloy Solder Joint Drainage Fittings - DWV
B16.24-1979	Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300
B16.29-1980	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
B16.31-1971	Nonferrous Pipe Flanges, 150, 300, 400, 600, 900, 1500, and 2500 lb
B16.39-1977	Malleable Iron Threaded Pipe Unions (Class 150, 250, and 300)
B19.3-1981	Safety Standard for Compressors for Process Industries
B31.1-1980 & B31.1a-1980 & B31.1b-1981 & B31.1c-1981 & B31.1d-1982	Power Piping
B40.1-1980	Gauges-Pressure Indicating Dial Type-Elastic Element
Z21.22-1979	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
Z124.1-1980	Plastic Bathtub Units

1.6 American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Standard:

90A-1980 Energy Conservation in New Building Design

1.7 American Society of Mechanical Engineers (ASME) Publications:

Boiler and Pressure Vessel Code and Interpretations:

Section IV Heating Boilers (1980; Addenda: Summer & Winter 1980; Summer & Winter 1981; Summer & Winter 1982)

Section VIII                      Pressure Vessels, Division 1 (1980;  
Addenda: Summer & Winter 1980; Summer  
& Winter 1981; Summer 1982 with Suppl  
& Winter 1982)

Section IX                        Welding and Brazing Qualifications  
(1980; Addenda: Summer & Winter 1980;  
Summer & Winter 1981; Summer & Winter  
1982)

1.8 American Society of Sanitary Engineering (ASSE) Standards:

1001                              Pipe Applied Atmospheric Type Vacuum  
Breakers (May 1966, Rev Jul 1980)

                                    Water Pressure Reducing Valves for Domestic  
Water Supply Systems (1964, Rev May 1981)

                                    Water Heater Drain Valves - 3/4-Inch Iron  
Pipe Size (Oct 1967)

1011                              Hose Connection Vacuum Breakers (Jun 1970,  
Rev Feb 1981)

                                    Backflow Preventers with Intermediate  
Atmospheric Vent (May 1972, Rev Sep 1978)

1.9 American Society for Testing and Materials (ASTM) Publications:

A 47-77                            Malleable Iron Castings

A 53-82                            Pipe, Steel, Black and Hot-Dipped, Zinc-  
Coated, Welded and Seamless

A 74-82                            Cast Iron Soil Pipe and Fittings

A 120-82                          Pipe, Steel, Black and Hot-Dipped Zinc-  
Coated (Galvanized) Welded and Seamless,  
for Ordinary Uses

A 126-73  
(R 1979)                          Gray Iron Castings for Valves, Flanges,  
and Pipe Fittings

A 183-80                          Carbon Steel Track Bolts and Nuts

A 518-80                          Corrosion-Resistant High-Silicon Iron  
Castings

A 536-80                          Ductile Iron Castings

B 32-76                            Solder Metal

B 42-82                            Seamless Copper Pipe, Standard Sizes

B 43-80	Seamless Red Brass Pipe, Standard Sizes
B 88-81	Seamless Copper Water Tube
B 306-81	Copper Drainage Tube (DWV)
B 641-81	Seamless and Welded Copper Distribution Tube (Type D)
C 564-70 (R 1982)	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
D 226-81	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
D 638-82a	Tensile Properties of Plastics
D 1004-66 (R 1981)	Initial Tear Resistance of Plastic Film and Sheeting
D 1248-81a	Polyethylene Plastics Molding and Extrusion Materials
D 1785-82	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2000-82	Rubber Products in Automotive Applications
D 2104-74 (R 1982)	Polyethylene (PE) Plastic Pipe, Schedule 40
D 2235-81	Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
D 2239-81	Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
D 2241-82	Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
D 2447-74 (R 1982)	Polyethylene (PE) Plastic Pipe, Schedules 40 and 80 Based on Outside Diameter
D 2464-76	Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D 2466-78	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
D 2467-76a	Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D 2564-80 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D 2609-74 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe

D 2657-79 Heat-Joining Polyolefin Pipe and Fittings

D 2661-82 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings

D 2662-82 Polybutylene (PB) Plastic Pipe (SDR-PR)

D 2665-82 Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

D 2666-82 Polybutylene (PB) Plastic Tubing

D 2672-80 Bell-End Poly(Vinyl Chloride) (PVC) Pipe

D 2683-80 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe

D 2737-81 Polyethylene (PE) Plastic Tubing

D 2846-82 Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems

D 2855-81 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

D 3000-73  
(R 1981) Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Outside Diameter

D 3035-81 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

D 3138-80 Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components

D 3139-77 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

D 3212-81 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

- D 3261-82                   Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- D 3309-81b                 Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems
- E 96-80                    Water Vapor Transmission of Materials
- E 156-68  
(R 1979)                   Determination of Phosphorus in High-Phosphorus Brazing Alloys
- F 437-82                   Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
- F 438-82                   Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
- F 439-82                   Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
- F 441-82                   Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
- F 442-82                   Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
- F 493-80                   Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

1.10 American Water Works Association (AWWA) Standards:

- B300-80                    Hypochlorites
- B301-81                    Liquid Chlorine
- C203-78                   Coal-Tar Protective Coatings and Linings for Steel Water Pipelines--Enamel and Tape--Hot-Applied
- M20-73                    Water Chlorination Principles and Practices

1.11 Cast-Iron Soil Pipe Institute (CISPI) Standards:

- 301-82                    Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Systems for Drain Waste or Vent, Sewer, Rainwater or Storm Drain Systems

310-82 Cast Iron Soil Pipe Institute's Patented Joint for Use in Connection with Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems

HSN-78 Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

1.12 Foundation for Cross-Connection Control & Hydraulic Research  
Publication:

Manual of Cross-Connection Control (1979, 6th Ed.; Rev Mar 1982)

1.13 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS) Standards:

SP-44 Steel Pipe Line Flanges (1982)

SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture (1975)

SP-69 Pipe Hangers and Supports - Selection and Application (1976)

SP-70 Cast Iron Gate Valves, Flanged and Threaded Ends (1976)

SP-71 Cast Iron Swing Check Valves, Flanged and Threaded Ends (1976)

SP-72 Ball Valves with Flanged or Butt-Welding Ends for General Service (1970)

SP-73 Silver Brazing Joints for Wrought Copper and Copper Alloy and Cast Copper Alloy Solder Joint Pressure Fittings (1982)

SP-78 Cast Iron Plug Valves, Flanged and Threaded Ends (1977)

SP-80 Bronze Gate, Globe, Angle and Check Valves (1974)

SP-83 Carbon Steel Pipe Unions Socket-Welding and Threaded (1976)

SP-84 Steel Valves - Socket Welding and Threaded Ends (1978)

SP-85 Cast Iron Globe and Angle Valves - Flanged and Threaded Ends (1976)

1.14 National Association of Plumbing-Heating-Cooling Contractors/  
American Society of Plumbing Engineers (NAPHCC/ASPE) Standard:

National Standard Plumbing Code (1980)

National Electrical Manufacturers Association (NEMA) Standard:

250-1979                      Enclosures for Electrical Equipment (1000  
Incl Rev 1                      Volts Maximum)

1.16 National Fire Protection Association (NFPA) Standards:

No. 13-1980                      Installation of Sprinkler Systems

No. 89M-1976                      Clearances for Heat Producing Appliances

National Sanitation Foundation (NSF) Testing Laboratory Standard:

Std. No. 14                      Plastic Piping System Components and  
Related Materials (Oct 1965, Rev Dec 1980)

1.18 Plastic Pipe Institute (PPI) Manual:

Plastics Piping Manual - (1st Ed.; 1976)

## 2. GENERAL REQUIREMENTS:

2.1 Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in their manufacture. Items of equipment shall be the standard products of a manufacturer engaged in the manufacture of the products. Threaded joints shall have American National taper pipe threads conforming to Fed. Std. H28 with graphite or inert filler and oil, with an approved graphite compound, or with polytetrafluoroethylene tape.

2.2 Verification of Dimensions: The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

2.3 Backflow: Protection against backflow and back-siphonage shall be provided in accordance with requirements of the NAPHCC/ASPE National Standard Plumbing Code. Reduced pressure principle, double check valve, atmospheric (nonpressure) type vacuum breaker, and pressure type vacuum breaker assemblies shall be in accordance with the Manual for Cross-Connection Control and shall be of a type tested, approved, and listed by the Foundation For Cross-Connection Control & Hydraulic Research as an approved backflow prevention device. Hose connection vacuum breakers, pipe applied atmospheric type antisiphon devices, and backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE Standards.

2.4 Welding: Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME Boiler and Pressure Vessel, Section IX.

3. SUBMITTALS: Shop drawings shall be submitted in accordance with the SPECIAL PROVISIONS and shall consist of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the system. Shop drawings shall be provided for the complete plumbing system and shall include piping layout and location of connections; dimensions for roughing-in, foundation, and support points; schematic (elementary) diagrams and wiring diagrams or connection and interconnection diagrams. Shop drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support method.

4. ELECTRICAL WORK: Electric motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, a.c. unless otherwise indicated. Motors shall be open, dripproof type unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be provided with the mechanical equipment. Motors and motor controllers shall conform to the applicable requirements of SECTION: ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contacts, and other equipment at the specified capacity including an allowable service factor, and other appurtenances necessary for the motor control specified. Manual or automatic control and protective or signal devices required for operation herein specified and any wiring required to such devices not shown on the electrical drawings shall be provided under this section. Complete electrical schematic (elementary), lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device shall be submitted for approval.

5. MATERIALS: Material shall be suitable for the pressures and temperatures encountered. Pipe, valves, and fittings shall conform to the respective publications and other requirements specified below.

5.1 Pipe and Fitting Material: Pipe material for various services shall be in accordance with Tables III and IV, attached to this section. Water service and waste pipe shall extend from approximately 6 inches above the lower floor or inside the structure wall to a point not less than 5 feet outside the structure. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot- and cold-water service shall bear the NSF seal "NSF-PW" and shall not be used in buildings greater than two stories in height. Polypropylene pipe shall conform to dimensional requirements for Schedule 40, Iron Pipe Size.

5.2 Flanges: Flanges shall be suitable for the required operating pressure and temperature conditions. Flange gaskets shall be fiber, plastic, or other synthetic material suitable for the service. Flanges shall be used on pipe sizes 3 inches and larger.

<u>Description</u>	<u>Standard</u>
Bronze Flanges and Flanged Fittings	ANSI B16.24
Nonferrous Pipe Flanges	ANSI B16.31
Steel Pipe Line Flanges	MSS SP-44
Gray Iron Castings for Valves, Flanges, and Pipe Fittings	ASTM A 126

5.3 Unions: Unions shall be used on pipe sizes 2-1/2 inches and smaller. Unions shall meet the dimensional requirements and tensile strength required by Fed. Spec. WW-U-531, and shall be suitable for the required operating pressure and temperature conditions.

<u>Description</u>	<u>Standard</u>
Unions, Brass or Bronze	Fed. Spec. WW-U-516
Carbon Steel Pipe Unions Socket-Welding and Threaded	MSS SP-83
Malleable Iron Threaded Pipe Unions	ANSI B16.39

5.4 Pipe Nipples:

<u>Description</u>	<u>Standard</u>
Nipples, Pipe, Threaded	Fed. Spec. WW-N-351

5.5 Valves: Valves used for water service shall have the zinc content limited to 6 percent for the stem, body, bonnet, wedge, or disk in contact with the fluid.

<u>Description</u>	<u>Standard</u>
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves	Fed. Spec. WW-V-35
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78

Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves-Socket Welding and Threaded Ends	MSS SP-84
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ANSI A112.14.1
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Temperature and Pressure Relief Valves for Hot Water Supply Systems	AGA Z21.22 and ASME Section IV
Gray Iron Castings for Valves, Flanges, and Pipe Fittings	ASTM A 126

#### 5.6 Pipe Jointing Materials, Gaskets:

<u>Description</u>	<u>Standard</u>
Calking, Lead Wool and Lead Pig	Fed. Spec. QQ-C-40
CISPI Patented Joint for use in Connection with Hubless Cast Iron Sanitary System	CISPI 310
Nonmetallic Gaskets for Pipe Flanges	ANSI B16.21
Neoprene Rubber Gaskets for Hub and Spigot Cast-Iron Soil Pipe and Fittings	CISPI NHS
Solder, Metal	ASTM B 32
Silver Brazing Joints for Wrought and Cast Solder-Joint Fittings	MSS SP-73
Phosphorus in High- Phosphorus Brazing Alloys	ASTM E 156

<u>Description</u>	<u>Standard</u>
PTFE Tape, for use with Threaded Metal or Plastic Pipe	Mil. Spec. MIL-T-27730
Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings	ASTM C 564
Calking Compound	Fed. Spec. TT-C-598, Type I
Lead	Fed. Spec. QQ-C-40, Type I
Copper	Fed. Spec. QQ-C-576, Sheet Form, Light, Cold-Rolled Temper
Flexible Elastomeric Seals	ASTM D 3139 or D 3212
Heat Joining of Polyolefin Pipe and Fittings	ASTM D 2657
Solvent Cement for Transition Joints between ABS AND PVC Nonpressure Piping Components	ASTM D 3138
Plastic Solvent Cement for ABS Plastic Pipe	ASTM D 2235
Plastic Solvent Cement for PVC Plastic Pipe	ASTM D 2564 and D 2855
Plastic Solvent Cement for CPVC Plastic Pipe	ASTM F 493
Pipe Jointing Method for PP Plastic Pipe	Mechanical Joint or Electrical Fusion Coil Method
Pipe Jointing Method for PE Plastic Pipe	Socket and Butt Fusion; Insert and Compression Fittings
Pipe Jointing Method for PB Plastic Pipe	Manufacturer's Recommendation
Pipe Jointing Method for Filament-Wound Reinforced Thermosetting Resin Pipe (RTRP)	Manufacturer's Recommendation

5.7 Miscellaneous:

<u>Description</u>	<u>Standard</u>
Pipe Threads (Except Dry Seal)	ANSI B2.1
Supports for Off-The-Floor Plumbing Fixtures	ANSI A112.6.1M
Metallic Cleanouts	ANSI A112.36.2
Plumbing Fixture Setting Compound	Fed. Spec. TT-P-1536, Type II
Asphalt-Saturated Felt	ASTM D 226
Coal-Tar Protective Coatings and Linings for Steel Water Pipelines	AWWA C203
Pipe Coating, Thermoplastic Resin or Thermosetting Epoxy Thermosetting Epoxy	Fed. Spec. L-C-530
Gauges - Pressure and Vacuum Indicating Dial-Type-Elastic Element	ANSI B40.1
Scheme for the Identification of Piping System	ANSI A13.1

5.8 Pipe Insulation Material: Insulation shall be as specified in SECTION: THERMAL INSTALLATION FOR MECHANICAL SYSTEMS.

6. PIPE HANGERS, INSERTS, AND SUPPORTS: Pipe hangers, inserts, and supports shall conform to MSS SP-58 and SP-69, except as specified below. Inserts shall be Type 18. Hangers shall be Type 1, 9, 10, or 11, and shall be adjustable or provided with turnbuckles, Type 13 or 15. Type 6 hangers may be used to support pipes from toilet rooms to main stacks when space does not permit the use of turnbuckles or adjustable clevis type hangers. Light duty clevis hangers shall conform to NFPA No. 13. Brackets for support of piping at walls shall be Type 31, 32, 33, or 34. Metallic pipes supported on beams or brackets shall be provided with a graphite or polytetrafluoroethylene (PTFE) slide plate and cradle having a minimum thickness of 1/2 inch. Beam clamps shall be Types 20, 21, 22, 23, 28, or 29. A retainer shall be provided with Type 23. Angle iron or channel clamps shall be Type 20-with a malleable iron heel plate added.

7. SPECIALTY VALVES: Specialty valves shall be provided on supplies to equipment and fixtures. Valves in connection with runouts, risers, branches, and mains shall be installed where indicated. Valves shall be gate valves, unless otherwise specified or indicated. Valves up to 3 inches shall be bronze, with threaded bodies for pipe and solder-type

connections for tubing. Valves 3 inches and larger in diameter shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application.

7.1 Wall Faucets: Wall faucets with vacuum breaker backflow preventer shall be brass with 3/4-inch male inlet threads, hexagon shoulder, and 3/4-inch hose connection. Faucet handle shall be securely attached to stem.

7.2 Wall Hydrants: Wall hydrants with vacuum breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through wall and to place the valve inside the building, so that the portion of the hydrant between outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4-inch exposed hose thread on spout and 3/4-inch male pipe thread on inlet.

7.3 Pressure and Temperature Relief Valves: Water heaters shall have a pressure relief valve and a temperature relief valve, or a combined pressure and temperature (P&T) relief valve. The pressure relief valve or the pressure relief element of a P&T relief valve must have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input by the heaters. A temperature relief valve or the temperature element of a P&T relief valve must have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves rated according to AGA Z21.22 shall be selected for systems where the input rating of the heaters is less than 200,000 Btuh. Relief valves rated according to ASME Section IV or ASME Safety Code No. CSD-1, shall be selected for systems where the input rating of the heaters is greater than 200,000 Btuh. Minimum relief valve size shall be 3/4 inch for inlet and outlet.

8. FIXTURES: Fixtures shall be water conservation type, unless otherwise specified in the National Standard Plumbing Code. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be true and straight. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture shall be trapped. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush valves and pop-up stoppers of lavatory waste drains, may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F. water temperature. Plumbing fixtures shall be as indicated in Tables I and II attached at the end of this section of the specifications.

8.1 Lavatories: Vitreous-china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate. The fixtures shall be of the minimum quality required for the type of structure in which installed, consideration being given to the expected life of the building.

8.2 Flush Valves: Flush valves shall have a nonhold-open feature with backcheck stop and a vacuum breaker. Flush valves shall be piston type having a minimum effective inside diameter of 2-5/8 inches.

8.3 Traps: Unless otherwise specified herein, traps shall be copper alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be not less than 20-gage copper alloy with walls 0.032-inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and waste tubing connecting to wall with escutcheon shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

8.4 Backflow Preventers: Atmospheric (nonpressure) type vacuum breakers shall be tested, approved, and listed by the Foundation for Cross-Connection Control & Hydraulic Research. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE 1012. Hose connection vacuum breakers shall be in accordance with ASSE 1011. Pipe applied atmospheric type vacuum breakers shall be in accordance with ASSE 1001. Air gaps in plumbing systems shall be in accordance with ANSI A112.1.2.

9. FLOOR DRAINS: Floor drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drain pipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or calked connection. In lieu of a calked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor drains shall conform to ANSI A112.21.1.

10. WATER COOLERS: Self-contained, mechanically refrigerated drinking water coolers shall be ARI listed in accordance with ARI 1010, shall use one of the halogenated hydrocarbons as a refrigerant, and shall have the capacity indicated at the standard rating conditions.

11. EYE-WASH FOUNTAIN shall be twin chrome-plated brass eye-wash heads mounted in a 20-gage stainless steel receptor. Valve shall be instant-on, self-closing, and easy-action, push handle operated. Mounting shall be with a 1-1/4 inch galvanized iron pipe pedestal with 9-inch floor flange. Provide a supply pipe of 3/8 inch ips and waste pipe of 1-1/4 inch ips.

12. EMERGENCY SHOWER shall be a 10-inch deluge shower with an instant-on self-closing valve pull chain and 8-inch ring. Provide a supply pipe of 1 inch ips.

13. WATER HEATERS: Water heater types and capacities shall be as indicated.

13.1 Automatic Storage Type: Heaters shall be the assembled product of one manufacturer, be ASME stamped for 150 psi working pressure, and have the National Board (ASME) registration. The thermal efficiency and standby heat loss shall comply with the requirements of ASHRAE 90. Heaters shall be complete with control system, temperature gage, and pressure gage, and shall have ASME rated temperature and pressure relief valve.

13.2 Electric Type: Electric type water heaters shall conform to Fed. Spec. W-H-196, Type IV, Series 2. Electric water heaters, 80 gallons or less, shall have a maximum total power input of 4,500 watts and shall be provided with dual heating elements. The size, capacity, voltage, and combined wattage of heating elements shall be not less than indicated.

14. AIR COMPRESSORS:

14.1 General: Air compressors shall conform to ANSI B19.3. Air compressor unit shall be a factory packaged assembly, including three-phase, 480 volts motors controls, switches, wiring, accessories, and motor controllers, in a UL-listed NEMA 250, Type 4 enclosure. Tank-mounted air compressors shall be manufactured to comply with UL listing requirements. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. Each compressor shall start unloaded and shall start and stop automatically by an enclosed diaphragm-type pressure switch mounted on the unit or in the unit-mounted control cabinet. Guards shall shield exposed moving parts. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. In addition, a three-position hand-off-automatic selector switch shall be provided for each motor. An intake air filter and silencer shall be provided with each compressor. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

14.2 Nonoil-Free Type Compressors: Compressors shall be two-stage, V-belt drive, capable of operating continuously against their designed discharge pressure, and shall operate at a speed not in excess of

1800 rpm. Compressors shall have the capacity and discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gage calibrated to 150 psi and equipped with a gage cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

14.3 Air Receivers: Receivers shall be designed for 200 psi working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with valves and accessories, including pressure gages and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with the ASME Section VIII, Division 1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

14.4 Pressure Regulators: The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 125 psi and a maximum temperature of 200 degrees F. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim, and threaded connections. The regulator valve shall include a pressure gage and shall be provided with an adjustment screw for adjusting the pressure differential from 0 to 125 psig.

15. GENERAL INSTALLATION REQUIREMENTS: Installation shall be as required by the NAPHCC/ASPE National Standard Plumbing Code and as specified herein. Neither hubless cast-iron nor plastic pipe shall be installed under concrete floor slabs. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. Piping shall be connected to the exterior service lines or capped or plugged, if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Utilities shall be installed below the frostline. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. A gate valve and drain on the water service line shall be installed inside the building as close to the floor or wall as possible.

15.1 Soil, Waste, Drain, and Vent Piping: Plastic vent piping shall not pass through roofs, fire walls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors. Cast-iron soil pipe hubs inside buildings shall be extended a minimum of 6 inches above the lowest floor where the floor is supported on the ground, and 6 inches above ground where the lowest floor is self-supporting.

## 15.2 Water Pipe, Fittings, and Connections:

15.2.1 Utilities: The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shut-off valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, and flush valves shall be anchored to prevent movement.

15.2.2 Cutting and Repairing: The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

15.2.3 Protection to Fixtures, Materials, and Equipment: Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

15.2.4 Mains, Branches, and Runouts: Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings will be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or prevent flexible movement of the lines. No water pipe shall be buried in floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

15.2.5 Pipe Drains: Pipe drains indicated shall consist of 3/4-inch hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 3/4-inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

15.2.6 Expansion and Contraction of Piping: Allowance shall be made throughout for expansion and contraction of water pipe. Branch connections from risers shall be made with ample swing or offset to avoid undue strain

on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

15.3 Compressed Air Piping (Nonoil-Free): Compressed air piping shall be installed as specified for water piping and suitable for 125 psig working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow. Plastic pipe shall not be used for compressed air line piping.

15.4 Joints: Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Threaded joints shall have American Standard taper pipe threads conforming to ANSI B2.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied. Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous, domestic hot- and cold-water systems in lieu of unions, welded, flanges, or threaded joints. Mechanical couplings will not be permitted in non-accessible places. The gasket shall be molded rubber conforming to ASTM D 2000, Grade No. 3BA610A15B44Z, maximum temperature of 200 degrees F. Coupling nuts and bolts shall be steel conforming to ASTM A 183. Fittings and coupling housing for grooved pipe shall be malleable iron conforming to ASTM A 47, Grade 35510, or ductile iron conforming to ASTM A 536, Grade 65-45-12. Mechanical couplings and fittings shall be of the same manufacturer. Unions and flanges shall not be concealed in walls, ceilings, or partitions. A dielectric union or flange shall be installed at the junction of dissimilar metals on pressure piping systems. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

15.4.1 Copper Tube: Joints for copper tubing shall be made with soldered or brazed fittings. Tube shall be cut square with burrs removed. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Care shall be taken to prevent annealing of tube and fittings when making connections. Solder joints shall be made with flux and wire form or paste-type solder. The flux for either 50/50 or 95/5 solder shall be mildly corrosive liquid or petroleum-based paste containing chlorides of zinc and ammonium. Core solder shall not be used. Joints in copper tube 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multiframe torch. Joint material shall be as follows:

Cold Water	50/50 or 95/5 Solder
DWV	50/50 or 95/5 Solder

Hot Water	95/5 Solder
Compressed Air	95/5 Solder

50/50 indicates 50 percent tin - 50 percent lead solder in accordance with ASTM B 32. 95/5 indicates 95 percent tin - 5 percent antimony solder in accordance with ASTM B 32.

15.4.2 Plastic Pipe: Joints for other plastic pipe shall be made in accordance with PPI Plastics Piping Manual. Joints for plastic pipe materials are made in the following manner:

<u>Pipe Material</u>	<u>Joint Method</u>
ABS	Solvent Cement
PVC and CPVC	Solvent Cement Elastomeric Threading Schedule 80 Pipe (Threading Schedule 40 Pipe is not Allowed) Flanged
PB	Socket Fusion Compression Type Coupling Plastic to Metal Transition Fitting

Threaded joints shall be used only where required for disconnection and inspection.

15.5 Dissimilar Pipe Materials: Connections to water heaters and between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

15.6 Protective Coatings for Pipe and Fittings: Exterior surfaces of metallic pipe and fittings, except copper, that are installed underground shall be thoroughly cleaned of foreign matter by wire brushing and solvent cleaning. Using tape conforming to AWWA C203 and primer as recommended by the tape manufacturer, the pipe shall be primed and immediately wrapped with the tape, applied with a 50 percent overlap. Joints and fittings shall be covered with the same primer and tape. Fittings shall be coated and wrapped after piping has been tested. Pipe shall be coated and wrapped during installation.

15.7 Pipe Sleeves and Flashing: Pipe sleeves shall be furnished and set in their proper and permanent location.

15.7.1 Sleeve Requirements: Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. The space between the pipe and sleeve shall be calked with sealant conforming to Fed. Spec. TT-C-598. A modular mechanical type sealing assembly may be

installed in lieu of a waterproofing clamping flange and calking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall or roof and shall be cut flush with each surface, except for special circumstances. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4-inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. The annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed with coal-tar, asphalt or other approved material. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior wall for pipe chase areas which are not designated as fire rated.

15.7.2 Flashing Requirements: Pipes passing through roof or floor waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and calked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with calking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. In addition, a waterproofing clamping flange shall be installed.

15.7.3 Optional Counterflashing: Instead of turning the flashing down into a dry vent pipe, or calking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

15.8 Fire Seal: Where pipes pass through fire walls, fire partitions, or floors above grade, a fire seal of mineral wool or similar noncombustible material shall be provided. At floors, the fire seal shall be placed behind the backup material.

15.9 Pipe Hangers, Inserts, and Supports: Pipe hangers, inserts, and supports shall be furnished and installed in their proper and permanent location. Inserts shall be installed in correct locations before the concrete is poured. For wood construction, joists shall be bridged where necessary, using lag screws of the same diameter as hanger rods for hanger fasteners. For piping and tubing up to and including 1-1/4 inch nominal size, 3/4-inch wide, 18-gage (minimum) steel strap-type, ring-type, or molded thermoplastic hangers may be used and shall be secured by screw fasteners. Supports for plastic pipe shall conform to the National Standard Plumbing Code. In corrosive atmospheres, hangers in contact with uninsulated copper tubing or brass pipe shall be electrolytically or epoxy coated, sized to suit the outside diameter of the pipe. Pipe supports for insulated pipe shall have a diameter large enough to include the insulation. The location of hangers and supports shall be coordinated with the structural work to assure that the structural members will support the intended load. In lieu of separate hangers or supports, the Contractor shall submit for approval a detailed drawing of the type of hanger or support proposed for hanging and supporting multiple pipes.

15.9.1 Horizontal Pipe Hangers and Supports: Horizontal pipe hangers and supports and support spacing for horizontal piping shall be in accordance with MSS SP-69. Hangers and supports shall be installed at locations not more than 3 feet from the ends of each runout and not over 1 foot from each change in direction of piping. The slide plate shall be cemented to the beam or bracket and the cradle shall be cemented or strapped to the pipe.

15.9.2 Vertical Piping: Supports shall be located at each floor, and spaced at intervals of not more than 15 feet, at intervals of not more than 8 feet from end of riser, and near vent terminations as approved. Support of piping at the floor shall not be provided for slab-on-grade floors.

15.10 Welded Installation: Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alinement, heat treatment, and inspection of weld shall conform to ANSI B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded at no additional cost to the Government. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics

or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

15.11 Pipe Cleanouts: Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast brass or cast iron ferrule with countersunk cast brass head screw plug shall be calked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single-story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium-plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

16. RELIEF VALVES: No other valves shall be installed between the relief valve and the water heater. The relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the valve shall be installed directly in a tapping in the tank or heater. When heaters are not provided with a relief valve tapping, the valve shall be installed in the hot-water outlet piping. A discharge pipe the size of the valve outlet shall be connected to the valve outlet and terminated at a safe location. An aquastat shall be installed in the tank or heater to shut-off the heat source when excess temperatures develop.

17. FIXTURES AND FIXTURE TRIMMINGS: Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies, shall be furnished and installed with fixtures. Exposed piping connections from the shut-off or stop valve to the fixture shall be polished chromium-plated copper tubing. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Exposed fixture trimmings and fittings shall be chromium-plated or nickel-plated brass, with polished bright surfaces. Plumbing fixtures and accessories shall be installed within the space shown. Stops for water closet seats shall be installed on the wall.

17.1 Fixture Connections: Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made absolutely gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural-rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

17.2 Flush Valves: Flush valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flush valves for water closets shall be installed 39 inches above the floor. Stops for the water closet seat shall be installed on the wall.

17.3 Height of Fixture Rims Above Floor: Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor.

17.4 Fixture Supports: Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

17.4.1 Support for Cellular-Masonry Wall Construction: Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate.

17.4.2 Support for Wood Stud Construction: Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4-inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

17.4.3 Wall-Mounted Water Closet Gaskets: Where wall-mounted water closets are specified in Table II, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair carrier manufacturer.

17.5 Backflow Prevention Devices: No plumbing fixture, equipment, or pipe connection shall be installed that will provide a cross connection or interconnection between a potable water supply and any source of non-potable water. The backflow prevention device shall be installed where indicated and located so that no part of the device will be submerged.

Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

17.6 Access Panels: Access panels shall be provided for concealed valves, controls, dampers, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced.

17.7 Traps: Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps for acid-resisting waste shall be of the same material as the pipe.

18. VIBRATION-ABSORBING FEATURES: Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed loading rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

19. COLOR CODING: Color coding for piping identification shall be as specified in SECTION: PAINTING, GENERAL.

20. ESCUTCHEONS: Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

21. TESTS, FLUSHING, AND STERILIZATION:

21.1 Plumbing System: The plumbing system shall be tested in accordance with the National Standard Plumbing Code.

21.2 Compressed Air Piping (Nonoil-Free): Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 150 psig and hold this pressure for 2 hours with no drop in pressure.

21.3 Defective Work: If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

21.4 System Flushing: After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to

produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flush valves and automatic control devices shall be adjusted for proper operation.

21.5 Operational Test: Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2-hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary fuel, water, and electricity.

21.6 Sterilization: After pressure tests have been made, the entire domestic hot- and cold-water distribution system to be sterilized shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be either liquid chlorine conforming to AWWA B301 or hypochlorite conforming to AWWA B300. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the

main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to insure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to insure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6-hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The sterilizing shall be repeated until tests indicate the absence of pollution for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

TABLE I. PLUMBING FIXTURE SCHEDULE

<u>"P" No.</u>	<u>Fixture Description</u>	<u>Classification</u>
P-1	Water Closet, elongated bowl w/flush valve (WW-P-541/1)	Part A - Type II, Style D, Class 9. Part C - Type IV, Class 4. Part D - Type I, Style F1, F2, F3, or F5 as required. Class 1, 2, or 3. Part E - Type I or II, Style 1, Model A.
	Urinals (WW-P-541/2) Siphon jet	Part A - Type I, Style A, Class 3. Part B - Type I, or II, Style A, Class 1 or 3.
	Lavatories (WW-P-541/4) Straight back	Part A - Type I. Part C - Type I, II, III, or Part A - Type I. IV, Class 1. Part D - Type III. Part E - Type I or II. Part F - Type I, Class 1, 2, or 3.
	Sinks, Kitchen (WW-P-541/5) Single bowl	Part A - Type I, Class 1. Part B - Type I. Part C - Type I. Part D - Type I.
	Service Sink (WW-P-541/5) Trap standard	Part A - Type II, Class 1, Mtg. A. Part B - Type II. Part C - Type I. Part D - Type II.
	Drinking Fountain (WW-P-541/6) Surface-mounted	Type I, Class A.

TABLE II. PLUMBING FIXTURE SCHEDULE

<u>Fixture</u>	<u>Minimum Overall Dimensions, Inches</u>	<u>Requirements or Remarks</u>
Water closet P-1	Length = 25-1/2 Width = 14 Height = 14-1/4	Seats: Molded plastic w/self sustaining check hinge of plastic covered copper alloy; plastic covered wood composition w/cadmium plated, chromium dipped, cold rolled carbon steel; metal post fastening nuts; black seat and seat bumper or back stops on wall. Flush connection and coupling to be long finish connection for top spud. Flush valve handle shall be copper alloy.
Urinals P-2 Siphon Jet	Front to back = 11-1/4 Width = 17-1/2 Height = 24-1/4	Top supply connection
Lavatories P-3 Straight back	All depths to be mfg. standard Width = 20 Front to back = 18 Back height = 3-1/2	Fixtures shall be first quality vitreous china. Drains and jam nuts shall be cast wrought copper alloy. Faucet handles shall be cast, formed handles shall be cast, formed or drop forged copper alloy. Stop valves and handles shall be copper alloy. Waste traps and hexagonal nut for slip joints shall be copper alloy. Strainer shall be copper alloy or corrosion-resisting steel. Interconnection between valves and spout for Part C - Type II faucets shall be of rigid type metal tubing.  Escutcheons shall be corrosion-resisting steel or copper alloy. Fixtures shall be supported by wall hangers. Faucets shall have replaceable seats and index turn handle. Faucet shall be provided with metal replaceable cartridge type control units or metal cartridge units with diaphragm which can be removed and replaced without special tools. Cartridge type units shall be designed to prevent dripping dripping and replacement of washers.

TABLE II. PLUMBING FIXTURE SCHEDULE (Cont)

<u>Fixture</u>	<u>Minimum Overall Dimensions, Inches</u>	<u>Requirements or Remarks</u>
Kitchen sink P-4 Single Bowl Size 1	Width = 24 Front to back = 21 Depth = 7-1/2	Sinks shall be porcelain enameled formed steel. Faucet bodies and spouts shall be cast or wrought copper alloy. Faucet handles shall be corrosion-resisting steel or copper alloy. Escutcheons shall be copper alloy or corrosion-resisting steel or copper alloy. Escutcheons shall be copper alloy or corrosion-resisting steel. Drain assembly including drain plug, cup strainer, cross bars, jam nuts, washer and coupling shall be copper alloy or corrosion-resisting steel. Stoppers shall be copper alloy or corrosion-resisting steel. Traps shall be of two-piece construction and shall be wrought copper alloy. Sinks shall be without drainboard and contain holes for faucet inlets and spouts. Faucets shall have metal single lever handle. Faucet spout strainer shall have internal threads.
Size 2	Width = 30 Front to back = 21 Depth = 7-1/2	
Service Sink P-5 Trap Standard	Width = 24 Front to back = 20 Splash back = 9	Service sink shall be enameled cast iron with copper alloy or corrosion-resisting steel rim guard. Faucet body and spout shall be copper alloy. Faucet handles and escutcheons shall be copper alloy or corrosion-resisting steel. Drain plug, strainer, cross bars, jam nuts, washer and coupling shall be copper alloy or corrosion-resisting steel. Traps shall be cast iron. Faucets shall be with top or bottom brace and shall include a backflow preventer. Faucets shall have replaceable seat and stems shall rotate onto seat. Faucet handles shall be lever or four-arm type.

TABLE II. PLUMBING FIXTURE SCHEDULE (Cont)

<u>Fixture</u>	<u>Minimum Overall Dimensions, Inches</u>	<u>Requirements or Remarks</u>
Drinking Fountains P-6 Surface-mounted	Width = 13-1/4 Front to back = 13 Height = 10	Fountains shall be vitreous china, corrosion-resisting steel or enameled cast iron as indicated. All accessories including bubblers, stops, stream regulators, flow controls, handles, pushbuttons and traps shall be copper zinc alloy. Strainer and drain shall be copper zinc alloy or corrosion-resisting steel. Automatic stream regulators or flow control shall be incorporated in the bubbler. Surface-mounted fountains shall have concealed fasteners. Fountains shall have simple bubbler and shall be for interior installation. Self-closing valves shall have pushbutton or cross-shaped index metal turn handle without hood. Drain outlet will be suitable for the installation. Exposed surfaces or corrosion-resisting steel fountains shall have No. 4 general polish finish.

Table III. Materials for Drainage, Waste, and Vent Piping Systems

Item No.	Pipe Material	SERVICE				
		A	B	C	D	E
1	Cast-iron soil pipe and fittings, hub and spigot, ASTM A 74	X	X	X	X	X
2	Cast-iron soil pipe and fittings hubless, CISPI 301		X		X	X
3	Cast-iron pipe, (threaded) DWV, ANSI A40.5		X		X	X
4	Cast-iron drainage fittings, threaded, ANSI B16.12 for use with Items 3 and 7		X		X	X

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain in Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste and Vent and Belowground
- \* - Hard Temper

Table III. Materials for Drainage, Waste, and Vent Piping Systems

Item No.	Pipe Material	SERVICE				
		A	B	C	D	E
5	Cast-iron screwed fittings (threaded) ANSI B16.4 for use with Items 3 and 7				X	X
6	Malleable-iron threaded fittings, galvanized ANSI B16.3 for use with Item 7				X	X
7	Steel pipe, seamless galvanized, ASTM A 120, or ASTM A 53, Type S, Grade B		X		X	X
8	Seamless red brass pipe, ASTM B 43				X	X
9	Bronze flanged fittings, ANSI B16.24 for use with Items 8 and 11				X	X
10	Cast copper alloy solder joint pressure fittings, ANSI B16.18 for use with Item 11				X	X
11	Seamless copper pipe, ASTM B 42				X	X
12	Cast bronze threaded fittings, ANSI B16.15				X	X
13	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X
14	Wrought copper and wrought copper alloy solder-joint drainage fittings. ANSI B16.29	X	X	X	X	X
15	Cast copper alloy solder joint drainage fittings, DWV, ANSI B16.23	X	X	X	X	X
16	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings, ASTM D 2661		X		X	
17	Polyvinyl chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665		X		X	X

TABLE IV. MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe Material	SERVICE			
		A	B	C	D
1	Malleable-iron threaded fittings, galvanized, ANSI B16.3 for use with Item 2	X	X	X	X
2	Steel pipe, seamless, galvanized, ASTM A 120, or ASTM A 53, Type S, Grade B	X	X	X	X
3	Seamless red brass pipe, ASTM B 43	X	X		X
4	Bronze flanged fittings, ANSI B16.24 for use with Items 3 and 5	X	X		X
5	Seamless copper pipe, ASTM B 42	X	X		X
6	Seamless copper water tube, ASTM B 88	X*	X*	X**	X**
7	Seamless and welded copper distribution tube (Type D) ASTM B 641	X	X		X
8	Cast bronze threaded fittings, ANSI B16.15 for use with Items 3 and 5	X	X		X
9	Wrought copper and bronze solder-joint pressure fittings, ANSI B16.22 for use with Items 6 and 7	X	X	X	X
10	Cast copper alloy solder-joint pressure fittings, ANSI B16.18 for use with Items 6 and 7	X	X	X	X
11	Polyethylene (PE) plastic pipe, Schedule 40, ASTM D 2104	X			
12	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter ASTM D 2447	X			

- A - Cold Water Aboveground
- B - Hot Water 180 F. Maximum Aboveground
- C - Compressed Air Nonoil-Free
- D - Cold Water Service Belowground
- \* - Type M - Hard
- \*\* - Type L - Hard

TABLE IV. MATERIALS FOR PRESSURE PIPING SYSTEMS (Cont)

Item No.	Pipe Material	SERVICE			
		A	B	C	D
13	Polyethylene (PE) plastic pipe (SDR-PR), ASTM D 2239	X			
14	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D 3261 for use with Items 11, 12, 13, and 16	X			
15	Plastic insert fittings for polyethylene (PE) plastic pipe, ASTM D 2609 for use with Items 11 and 13	X			
16	Polyethylene (PE) plastic tubing, ASTM D 2737	X			
17	Polybutylene (PB) plastic hot and cold water distribution systems, ASTM D 3309	X	X		
18	Polybutylene (PB) plastic pipe (SDR-PR), ASTM D 2662	X	X		
19	Polybutylene (PB) plastic pipe (SDR-PR) based on outside diameter, ASTM D 3000	X	X		
20	Polybutylene (PB) plastic tubing, ASTM D 2666	X			
21	Chlorinated polyvinyl chloride (CPVC) plastic hot-water distribution system, ASTM D 2846	X	X		
22	Polyvinyl chloride (PVC) plastic pipe Schedules 40, 80, and 120, ASTM D 1785	X			
23	Polyvinyl chloride (PVC) plastic pipe (SDR-PR), ASTM D 2241	X			
24	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X			
25	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, Schedule 80, ASTM D 2467	X			

TABLE IV. MATERIALS FOR PRESSURE PIPING SYSTEMS (Cont)

Item No.	Pipe Material	SERVICE			
		A	B	C	D
26	Threaded polyvinyl chloride (PVC) plastic pipe fittings, Schedule 80, ASTM D 2464	X			
27	Bell-end polyvinyl chloride (PVC) pipe, ASTM D 2672	X			
28	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X		