

SECTION 33 51 00
NATURAL-GAS DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and procedures for the construction of outside underground gas distribution system for mixture of natural and manufactured gas, complete, ready for operation, including cathodic protection if required, all appurtenant structures, and connections to new building structures and to existing gas supply. This specification does not apply to LPG distribution systems.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH MOVING.
- B. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 ABBREVIATIONS

- A. HDPE: High-density polyethylene plastic
- B. PE: Polyethylene plastic
- C. WOG: Water, oil and gas
- D. NRTL: National recognized testing laboratory

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.6 COORDINATION

- A. Coordinate connection to natural-gas main with Utility Company.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:**A. Products Criteria:**

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Utility Company having jurisdiction over the connection to public natural-gas lines and the extension, and/or modifications to public utility systems.**1.8 APPLICABLE PUBLICATIONS****A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.****B. American National Standards Institute (ANSI):**

- B31.8-2010..... Gas Transmission and Distribution Piping Systems
- B109.1-92..... Diaphragm-Type Gas Displacement Meters (Under 500-Cubic-Foot-per-hour Capacity)
- B109.2-2000..... Diaphragm-Type Gas Displacement Meters (500-Cubic-Foot-per-hour Capacity and over)
- B109.3-92..... Rotary-Type Gas Displacement Meters
- IAS LC 1-2005..... Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
- Z21.18-07/CSA 6.3-07 Gas Appliance Pressure Regulators
- Z21.21-2005/CSA 6.5 Automatic Valves for Gas Appliances
- Z21.41-2003/CSA 6.9 Quick Disconnect Devices for Use with Gas Fuel Appliances
- Z21.75-2007/CSA 6.27 Connectors for Outdoor Gas Applications and Manufactured Homes
- Z21.80a-2005/CSA 6.22a Line Pressure Regulators, Addenda 1 to Z21.80-2003/CSA 6.22

C. American Petroleum Institute (API):

- Spec 6D-2010 Pipeline Valves

D. American Society of Civil Engineers (ASCE):

- 25-06 Earthquake Actuated Automatic Gas Shutoff Devices

E. American Society of Mechanical Engineers (ASME):

- B1.20.1-1983..... Pipe Threads, General Purpose, Inch
- B1.20.3-2008..... Dryseal Pipe Threads (Inch)
- B16.3-2006..... Malleable Iron Threaded Fittings: Classes 150 and 300
- B16.5-2009..... Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24
Metric/Inch Standard
- B16.9-2007..... Factory-Made Wrought Buttwelding Fittings
- B16.11-2009..... Forged Fittings, Socket-Welding and Threaded
- B16.20-2007..... Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and
Jacketed
- B16.26-2006..... Cast Copper Alloy Fittings for Flared Copper Tubes
- B16.33-2002..... Manually Operated Metallic Gas Valves for use in Gas Piping
Systems up to 125 psi (Sizes NPS 1/2 through NPS 2)
- B16.34-2009..... Valves - Flanged, Threaded and Welded End
- B16.38-2007..... Large Metallic Valves for Gas Distribution Manually Operated,
NPS 2-1/2 (DN 65) to NPS 12 (DN 300), 125 psig (8.6 bar)
Maximum
- B16.39-2009..... Malleable Iron Threaded Pipe Unions: Classes 150, 250, and
300
- B16.40-2008..... Manually Operated Thermoplastic Gas Shutoffs and Valves in
Gas Distribution Systems
- B18.2.1-2010..... Square, Hex, Heavy Hex, and Askew Head Bolts and Hex,
Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch
Series)
- B31.8-2010..... Gas Transmission and Distribution Piping Systems
- MFC-4M-1986 Measurement of Gas Flow by Turbine Meters

F. American Society of Safety Engineers (ASSE):

- 1079-2005 Dielectric Pipe Unions

G. American Society for Testing and Materials (ASTM):

A53/A53M-10	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A126-042009)	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A234/A234M-11	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
A312/A312M-11	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
B210-04.....	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
B241/B241M-10	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
B584-11	Copper Alloy Sand Castings for General Applications
D2513-11e1	Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
D2517-06	Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
D2683-10	Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
D2774-08	Underground Installation of Thermoplastic Pressure Piping
D3261-10a	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
E84-11	Standard Test Method for Surface Burning Characteristics of Building Materials

H. American Water Works Association (AWWA):

C203-08	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied
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I. American Welding Society (AWS):

A5.8/A5.8M:2004	Filler Metals for Brazing and Braze Welding
D10.12/D10.12M:2000	Guide for Welding Mild Steel Pipe

J. Manufacturers Standardization Society (MSS):

SP-78-2005	Gray Iron Plug Valves Flanged and Threaded Ends
SP-110-2010	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

K. National Fire Protection Agency (NFPA):

54-2009 National Fuel Gas Code

70-2011 National Electric Code

L. Society of Automotive Engineers (SAE):

J513-199901 Refrigeration Tube Fittings - General Specifications *HS-
150/2000*

M. Underwriters Laboratories (UL):

UL 429-2010 Electrically Operated Valves

1.9 WARRANTY

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: Steel pipe shall match existing. Copper tubes are not allowed by code for natural gas distribution in the United States.
- B. Fittings:
1. Malleable-Iron Threaded Fittings shall meet ASME B16.3, Class 150 or Class 300 to match existing, standard pattern. Threaded joints are not permitted except at valve connections.
 2. Butt weld fittings shall be wrought steel, per ASME B16.9.
 3. Wrought-Steel Welding Fittings shall meet ASTM A234 for butt welding and socket welding.
 4. Unions shall be ASME B16.39, Class 150, Class 250, or Class 300 to match existing, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 5. Forged-Steel Flanges and Flanged Fittings shall be ASME B16.5 or ASME B16.11 to match existing, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections shall be threaded or butt welded to match pipe.
 - c. Lapped Face is not permitted underground.
 - d. Gasket Materials shall be ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts shall be ASME B18.2.1, carbon steel aboveground and stainless steel underground.

6. Protective Coating for Underground Piping:

- a. Factory-applied, three-layer coating of epoxy, adhesive, and polyethylene PE).
- b. Coal Tar Enamel Coating on exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal-tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous-glass mat as specified in Appendix Sec. A2.1 of AWWA C203.
- c. Joint cover kits shall include epoxy paint, adhesive, and heat-shrink PE sleeves.

7. Mechanical Couplings may include to match existing:

- a. Stainless steel or steel flanges and tube with epoxy finish.
- b. Buna-nitrile seals.
- c. Stainless steel or Steel bolts, washers, and nuts.
- d. Couplings shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anodes.

C. Aluminum Tubing shall comply with ASTM B210 and ASTM B241/B241M.

- 1. Aluminum Alloy 5456 is prohibited.
- 2. Protective coating shall be factory-applied and capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
- 3. Flare fittings shall comply with ASME B16.26 and SAE J513-199901 and the following:
 - a. Copper-alloy fittings shall include metal-to-metal compression seal without gasket.
 - b. Dryseal threads shall comply with ASME B1.20.3.
- 4. Steel Mechanical Couplings shall be capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe. Include:
 - a. Steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Steel bolts, washers, and nuts.
 - d. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

- A. Weatherproof Vent Cap shall be cast or malleable-iron increaser fitting with corrosion-resistant wire screen, and free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape shall be suitable for natural-gas.
- B. Welding filler metals shall comply with AWS D10.12 for appropriate wall thickness and chemical analysis of steel pipe being welded.

- C. Brazing filler metals shall be alloy with a melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. All types of valves shall be accessible, labeled and specified for use for controlling multiple systems.
- B. Metallic Valves, NPS 2 (DN 50) and smaller shall comply with ASME B16.33, and have the following characteristics:
1. CWP Rating: Verify pressure with VA.
 2. Threaded ends complying with ASME B1.20.1.
 3. Dryseal threads on flare ends that comply with ASME B1.20.3.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 5. Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. Metallic Valves, NPS 2-1/2 (DN 65) and larger shall comply with ASME B16.38.
1. CWP Rating: Verify pressure with VA.
 2. Flanged Ends shall comply with ASME B16.5 for steel flanges.
 3. The initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim or match existing shall comply with MSS SP-110, and have the following characteristics:
1. Bronze body complying with ASTM B584.
 2. Chrome-plated brass ball and bronze, blowout proof stem.
 3. Seats shall be reinforced TFE and blowout proof.
 4. Include separate packnut with adjustable-stem packing threaded ends.
 5. Ends shall be threaded, flared, or socket and valve shall have a CWP rating of 600 psi (4140 kPa).
 6. Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction, suitable for natural-gas service with "WOG" indicated on valve body.
- E. Steel valves shall have capacity to operate in lines with 100 psi 690 kPa) working pressure.
1. Valves 1-1/2 inches (40 mm) and smaller installed underground shall conform to ASME B16.34, carbon steel, socket weld ends.
 2. Valves 1-1/2 inches (40 mm) and smaller, installed aboveground, shall conform to ASME B16.34, carbon steel, socket weld or threaded ends.
 3. Valves 2 inches (50 mm) and larger shall conform to API spec 6D, carbon steel, butt weld ends.

4. Aboveground valves 2 inches or larger (50 mm) shall conform to API Spec 6D, carbon steel, butt-welded or flanged ends.

5. Cast iron valves shall conform to ASTM A126, Class B, Type 301 or 302.

F. Valve Boxes shall be cast iron, two-section box.

1. Top section shall include a cover with "GAS" lettering.

2. Bottom section shall have a base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.

3. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Automatic gas valves shall comply with ANSI Z21.21/CSA 6.5.

B. Electrically operated valves shall comply with UL 429. Include 120-V ac, 60 Hz, Class B, continuous-duty molded replaceable coil with visual position indicator.

2.6 EARTHQUAKE VALVES

A. Valves shall automatically stop gas flow when actuated by earth tremor and shall be single seated with manual reset. Do not provide manual shut-off attachments.

1. Valve shall comply with ASCE 25 and automatically shut bubble tight within five seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 gravity with a period of 0.4 seconds. The valve shall not shut-off when subjected for five seconds to horizontal, sinusoidal oscillations having a peak acceleration of 0.4 gravity with a period of 0.1 second; a peak acceleration of 0.08 gravity with a period of 0.4 second or 1.0 second.

2. Valve should be rated for 125 psi 850 kPa) with flanged ends for pipe sizes above 2 inches (50 mm). Valves should have threaded ends for pipe sizes 2 inches (50 mm) and under.

3. Approvals: UL listed, State of California Standards for Earthquake Actuated Automatic Gas Shut-Off Systems.

2.7 VALVE BOXES

A. Provide cast iron extension box with screw or slide type adjustment and flared base. Minimum thickness of metal, 3/16 inch (5 mm). Box shall be of such length as can be adapted, without full extension, to depth of cover required over pipe at valve location with the word "GAS" in cover.

2.8 PRESSURE REGULATORS

A. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Ferrous bodies. Regulators should be:

1. Single stage and suitable for natural-gas, having a steel jacket and corrosion-resistant components and elevation compensator. End Connections should be threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators shall comply with ANSI Z21.80a/CSA 6.22a, with a maximum inlet pressure to match regulator.

- C. Line Pressure Regulators shall comply with ANSI Z21.80a/CSA 6.22a with a maximum inlet pressure to match regulator.

2.9 DIELECTRIC FITTINGS

- A. Dielectric Unions shall comply with ASSE 1079 and have a pressure rating verified by VA.
- B. Dielectric Flanges shall comply with ASSE 1079 and have a pressure rating verified by VA.
- C. Dielectric-Flange insulating kits shall have a pressure rating verified by VA.

2.10 LABELING AND IDENTIFYING

- A. Detectable warning tape shall be acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural-gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.2 METALLIC PIPING INSTALLATION

- A. Heating trenches, storm and sanitary sewer lines, and water mains shall have right of way.
- B. Warning tape shall be continuously placed 12 inches (300 mm) above buried gas lines.
- C. Main services and main service shut off valves shall have a 24 inch (600 mm) minimum cover or as recommended by local utility.
- D. Service lines shall have an 18 inch (450 mm) minimum cover or as recommended by local utility.
- E. Where already provided, the main shall be concrete-encased or sleeved.
- F. Connections between metallic and plastic piping shall be made only outside, underground, and with approved transition fittings.

3.3 BUILDING SERVICE LINES

- A. Before entering building, underground service line shall rise above grade close to building to permit possible gas leaks to vent themselves.
- B. Connect service lines to top of mains by two-strap service clamp or coupling socket) welded to main and into which is screwed a street tee and street elbow swing, joint assembly.
- C. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few as joints as practicable using standard

lengths of pipe. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in ANSI B31.8.

3.4 OUTDOOR PIPING INSTALLATION

- A. Comply with ASTM D2774 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least to match existing depth below finished grade. Minimum cover depth is 18 inches (450 mm). Natural-gas piping installed less than 18 inches (450 mm) below finished grade shall be installed in vented containment conduit.
- C. Install fittings for changes in direction and branch connections.
- D. Install pressure gauge in kind for each service regulator.

3.5 PIPE SLEEVES

- A. Pipe shall be continuous through sleeves. Set sleeves in place before concrete is poured. Seal between sleeve/core opening and the pipe with modular mechanical type link seal. All sleeves shall be vented.
- B. Provide sleeves where gas lines pass through retaining walls, foundation walls or floors. Split sleeves may be installed where existing lines pass thru new construction.

3.6 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- F. Do not install valves under pavement unless shown on drawings.
- G. Clean valve interior before installation.

3.7 VALVE BOXES

- A. Set cover flush with finished grade.
- B. Protect boxes located in roadway against movement by a concrete slab at least 3 feet (900 mm) square by 6 inches (150 mm) deep.
- C. Set other valve boxes with a concrete slab 18 inches (450 mm) by 18 inches (450 mm) by 6 inches (150 mm) deep and set flush with grade.
- D. All exposed portions of valve boxes shall be painted bright yellow.

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

3.9 LABELING AND IDENTIFYING

- A. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 PIPE CLEANING

- A. All pipe sections shall be blown down with 100 psi (690 kPa) air to remove all sand, soil and debris.
- B. Blow down procedure shall be done after system is complete, but before valves are installed.

3.11 CATHODIC PROTECTION

- A. If cathodic protection is in place, replace in kind.

3.12 TESTS

- A. Piping System: Inspection, testing and purging shall be in accordance with NFPA 54 and ASME B31.8. Maximum working pressure to be verified with VA.

- B. Cathodic Protection System:

1. Testing of Anodes: Prior to connecting anode lead wire to the piping, insert a millimeter in the circuit and measure and record current output of each anode. When maximum current outputs, as set below, for the different sizes of anodes are exceeded, insert nickel chromium resistance wire in the circuit to reduce current output to maximum allowable for a given size anode. Resistance wire connections to anode lead wires shall be accomplished with silver solder and soldered joints wrapped with a minimum of three layers of high dielectric strength electrical tape. Cover with rubber all nickel chromium resistance wire. Maximum allowable current outputs for the different size anodes to allow for design life are as follows:

Weight Bare Anodes	Allowable Current Output
5 lb (2.3 kg) Anode	10 Milliamperes
9 lb (4 kg) Anode	20 Milliamperes
17 lb (7.7 kg) Anode	40 Milliamperes
32 lb (14.5 kg) Anode	75 Milliamperes

2. Final Test: Final test of the cathodic protection system shall include measuring pipe-to-soil potentials over the entire system. Make potential measurements with potentiometer voltmeter (minimum internal resistance of 50,000 ohms per volt) and a copper/copper sulfate reference electrode placed at the finished grade level and directly over the pipe. Adequate number of measurements shall be taken over the extent of piping to insure that a minimum potential value of -0.85 volts exists over all new gas piping. Upon completion of testing, a report setting forth potential values acquired by location shall be submitted to the Government.

3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- C. Containment conduit shall be steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.14 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 - 1. NPS 2 (DN 50) and smaller use bronze plug valves.
 - 2. NPS 2-1/2 (DN 65) and larger use Cast-iron, lubricated plug valves.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.

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