

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 natural 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 WORK (SHORT FORM).
- B. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- D. Where soil resistivity is less than 4000 ohm-cm or when required by gas utility, Section 26 42 00, CATHODIC PROTECTION.
- E. Metering: SECTION 25 10 10, ADVANCED UTILITY METERING SYSTEM.

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 Facilities.

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-Feet-per-hour Capacity)

B109.2-2000.....Diaphragm-Type Gas Displacement Meters (500-
Cubic-Feet-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

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 be as per ASTM A53, black steel, Schedule 40, Type E or Type S, Grade B. 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, 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, 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, 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. Not Used.
 - c. Joint cover kits shall include epoxy paint, adhesive, and heat-shrink PE sleeves.
7. Mechanical Couplings shall include:
- a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-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. Corrugated, Stainless-Steel Tubing shall comply with ANSI/IAS LC 1 and ASTM A312, corrugated, Series 300 stainless steel.
- 1. Coating shall be PE with flame retardant with surface-burning characteristics determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 - 2. Fittings shall be copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - 3. Striker Plates shall be steel, designed to protect tubing from penetrations.
 - 4. Manifolds shall be malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 - 5. Operating-Pressure Rating shall be 5 psi (34.5 kPa).
- D. Not Used.
- E. PE Pipe: Pipe shall conform to ANSI B31.8 or ASTM D2513.
- 1. Minimum wall thickness shall conform to ASME B31.8. PE pipe is for underground use only. Polyethylene pipe shall be marked "GAS" and it is not be used where gas pressures are above 100 psi (690 kPa) or with operating temperatures below 20 deg F (7 deg C) or above 140 deg F (60 deg C).
 - 2. PE Fittings shall be as per ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type.

3. PE Transition Fittings shall be factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53, black steel, Schedule 40, Type E or S, Grade B.
 4. Polyethylene pipe joints shall be heat fused, either butt fusion or socket fusion.
 5. Not Used.
 6. Transition Service-Line Risers shall be factory fabricated and leak tested.
 - a. Underground Portion shall be PE pipe complying with ASTM D2513, connected to steel pipe complying with ASTM A53, Schedule 40, // Type E or Type S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection. Include factory-connected anode, tracer wire connection and ultraviolet shield.
 - c. Stake supports with factory finish to match steel pipe casing or carrier pipe. Bridging sleeve over mechanical coupling.
 7. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - a. PE body with molded-in, stainless steel support ring.
 - b. Buna-nitrile seals.
 - c. Acetal collets.
 - d. Electro-zinc-plated steel stiffener.
 8. Not Used.
 9. Not Used.
- F. Not Used.

2.2 PIPING SPECIALTIES

- A. Outdoor, Appliance Flexible Connectors shall comply with ANSI Z21.75/CSA 6.27, made of corrugated stainless steel tubing with polymer coating.
 1. Operating-Pressure Rating shall be 0.5 psi (3.45 kPa) with zinc-coated steel end fittings. Threaded ends shall comply with ASME B1.20.1. Maximum Length shall be 72 inches (1830 mm).
- B. Not Used.
- C. Not Used.
- D. Not Used.
- E. Not Used.
- F. Not Used.

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 of 125 psi (862 kPa).
 - 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. Not Used.
- D. One-Piece, Bronze Ball Valve with Bronze Trim 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. Not Used
- F. 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. Not Used.
 4. Not Used.
 5. Cast iron valves shall conform to ASTM A126, Class B, Type 301 or 302.
- G. PE Ball Valves shall comply with ASME B16.40. Valves in sizes 1/2 inch to 6 inches (15 mm to 150 mm) may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.
1. CWP Rating: 80 psi (552 kPa) with an operating temperature of Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
- H. 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 - NOT USED

2.6 EARTHQUAKE VALVES - NOT USED

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.
- B. Provide 1 "T" handle socket wrenches of 5/8 inch (16 mm) round stock long enough to extend 2 feet (600 mm) above top of deepest valve box.

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. Not Used.
- C. Line Pressure Regulators shall comply with ANSI Z21.80a/CSA 6.22a with a maximum inlet pressure of 10 psi (69 kPa).
- D. Not Used..

2.9 SERVICE METERS

- A. Meters shall comply with Section 25 10 10, ADVANCED UTILITY METERING SYSTEM and ANSI B109.2.
- B. Gas meters shall be of type approved by local gas Utility as specified herein.
- C. Meters shall be pedestal mounted. Meters shall be provided with over-pressure protection as specified in ASME B31.8 tamper-proof protection and frost protection.
- D. Diaphragm-Type service meters shall comply with ANSI B109.1 with a maximum inlet pressure of 690 kPa (100 psi) Insert pressure.
- E. Rotary-Type service meters shall comply with ANSI B109.3 with a maximum inlet pressure of 100 psi (690 kPa).
- F. Turbine meters shall comply with ASME MFC-4M with a maximum inlet pressure of 100 psi (690 kPa).
- G. Service-Meter Bars shall be malleable- or cast iron frame for supporting service meter and include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
 - 1. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
- H. Not Used.

2.10 DIELECTRIC FITTINGS

- A. Dielectric Unions shall comply with ASSE 1079 and have a pressure rating of 125 psi (860 kPa) minimum at 180 deg F (82 deg C).
- B. Dielectric Flanges shall comply with ASSE 1079 and have a pressure rating of // 125 psi (860 kPa) minimum at 180 deg F (82 deg C).
- C. Dielectric-Flange insulating kits shall have a pressure rating of 150 psi (1035 kPa).

2.11 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 indicated, the main shall be sleeved.
- F. Connections between metallic and plastic piping shall be made only outside, underground, and with approved transition fittings.

3.3 NON-METALLIC PIPE INSTALLATION

- A. Install pipe in trench in accordance with recommendations of the pipe manufacturer. Provide sufficient slack to allow for expansion and contraction.
- B. Joints shall be fusion welds made in accordance with the recommendations of the polyethylene pipe manufacturer. Adhesive joints for fiberglass plastic pipe shall be made in accordance with manufacturer's recommendations.
- C. All offsets in piping shall be made with manufactured fittings. Bending of piping to form offsets shall not be permitted.
- D. Connections between plastic pipe and metal pipe shall be made in accordance with recommendations of the pipe manufacturer.
- E. Copper Tracer Wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections

are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 1000 feet (300 m), provide a 5 pound (2.3 kg) magnesium anode attached to the main tracer wire by solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

3.4 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. Install gas service lines to point of connection within approximately 5 feet (1500 mm) outside of buildings to which such service is to be connected and make connections thereto. The point of delivery is the shutoff valve.
- C. 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.
- D. 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.
- E. Not Used.

3.5 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) 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 downstream from each service regulator.

3.6 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.

3.7 SERVICE-METER ASSEMBLY INSTALLATION

- A. Install service-meter assemblies aboveground.
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Not Used.

3.8 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. Not Used.
- 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.

3.9 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.

3.10 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.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Install tee fitting with capped nipple in bottom to form drip sediment traps. Install as close as practical to inlet of each appliance.

3.11 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.

3.12 CONCRETE BASES - NOT USED

3.13 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.

3.14 CATHODIC PROTECTION

- A. Where soil resistivity is less than 4000 ohm-cm or when required by gas utility, Section 26 42 00, CATHODIC PROTECTION is required.

3.15 DEMONSTRATION - NOT USED

3.16 TESTS

- A. Piping System: Inspection, testing and purging shall be in accordance with NFPA 54 and ASME B31.8. Maximum working pressure will be 10 psi.
- 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.

3.17 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Not Used.
- C. Not Used.

3.18 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. PE valves.
 2. NPS 2 (DN 50) and smaller use bronze plug valves.
 3. NPS 2-1/2 (DN 65) and larger use Cast-iron, lubricated plug valves.

3.19 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, regular-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- B. Not Used.
- 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, regular-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- D. Not Used.
- 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, regular-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.

--- E N D ---