



SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Strainers.
5. Natural gas pressure regulators.
6. Natural gas pressure relief valves.
7. Underground pipe markers.
8. Bedding and cover materials.

1.2 REFERENCES

A. General: Comply with appropriate standards.

1. American National Standards Institute: ANSI.
2. American Society of Mechanical Engineers: ASME.
3. American Society for Testing and Materials: ASTM.
4. American Welding Society: AWS.
5. American Water Works Association: AWWA.
6. Manufacturers Standardization Society of the Valve and Fittings Industry: MSS.
7. National Fire Protection Association: NFPA.
8. Underwriters Laboratories Inc.: U.L.
9. American Gas Association: AGA.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded connections to valves, equipment.
- C. Provide pipe hangers and supports in accordance with other sections.



- D. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit data on all pipe materials, fittings specialties, and accessories.
- B. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit data on all materials, fittings, accessories and equipment.
- C. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- F. Shop Drawings - Provide product data for each type of the following:
 - 1. Piping.
 - 2. Fittings.
 - 3. Joints.
 - 4. Piping specialties.
 - 5. Corrugated, stainless-steel tubing with associated components.
 - 6. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 7. Pressure regulators. Indicate pressure ratings and capacities.
 - 8. Service meters including supports.
 - 9. Mechanical sleeve seals.
 - 10. Escutcheons.
 - 11. Supports.
 - 12. Remote meter reading accessories.
 - 13. Seismic gas shut off valves.
- G. Seismic-Design Submittal: Provide for natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.



- H. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.5 WARRANTY

- A. Furnish one-year minimum warranty.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M forged steel welding type.
 - 2. Joints: ASME B31.9, welded for 3" and larger; threaded for 2" and smaller.
 - 3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
- B. Plastic Pipe: ASTM D-2513 Schedule 40 Polyethylene.
 - 1. Fittings: PE 2406 butt-fused.
 - 2. Joints: PE 2406 butt-fused.

2.2 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, 150 psig.
 - 2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.3 PIPING

- A. Inside steel piping:
 - 1. For low pressure 0.5 psig or less use standard weight black steel pipe with 150 psig threaded malleable iron fittings for piping 4 in. and smaller.
 - 2. For pressure above 5 psig, all piping shall be welded.
- B. Underground piping:
 - 1. Steel pipe with Dresser type and steel welding fittings. Pre-wrap with Mill-wrapped corrosion protection extruded polyolefin coating in accordance with Gas Company requirements, equal to Energy Coating Co. or PlexCo.
 - 2. High density polyethylene pipe and fittings in accordance with ASTM D-2513, Grades 2306, 3306, and 3408 with fusion joints only, equal to Driscopipe 8100-DRII Series.



- C. Underground drips shall be AGA and local gas company approved and shall be cast iron or tar coated welded steel pots with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS DRIP.
- D. In no case shall any gas pipe be less than $\frac{3}{4}$ inch.

2.4 REGULATOR VENT PIPING, ABOVE GRADE

- A. Indoors: Same as natural gas piping, above grade.
- B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.5 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 - 1. Ferrous Piping: Class 150, malleable iron, threaded.
 - 2. Copper Piping: Class 150, bronze unions with soldered brazed joints.
- B. Flanges for Pipe 2-1/2 inches and Larger:
 - 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 - 2. Copper Piping: Class 150, slip-on bronze flanges.
 - 3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.6 STRAINERS

- A. Manufacturers:
 - 1. **Mueller Steam Specialty.**
 - 2. **O.C. Keckley Company.**
 - 3. **Spirax Sarco, Inc.**
- B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.7 NATURAL GAS PRESSURE REGULATORS

- A. Manufacturers:
 - 1. **Equimeter.**
 - 2. **American.**



3. **Sensus.**

B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

1. Comply with ANSI Z21.80.
2. Temperatures: minus 20 degrees F to 150 degrees F.
3. Body: Cast iron with neoprene gasket.
4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
5. Disk, diaphragm, and O-ring: Nitrile.
6. Minimum Inlet Pressure: 5 psi.
7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

C. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers:
 - a. **Equimeter.**
 - b. **American.**
 - c. **Sensus.**
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 60 psig.

2.8 NATURAL GAS PRESSURE RELIEF VALVES

A. Manufacturers:

1. **Fisher.**



2. **American.**
 3. **Or Approved Equal**
- B. Product Description: Spring loaded type relief valve.
1. Body: Aluminum.
 2. Diaphragm: Nitrile.
 3. Orifice: Stainless steel.
 4. Maximum operating temperature: 150 degrees F.
 5. Inlet Connections: Threaded.
 6. Outlet or Vent Connection: Same size as inlet connection.

2.9 UNDERGROUND LABELING & IDENTIFYING

- A. Detectable Warning Tape: Acid and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils 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 deep; colored yellow.

2.10 GAS VENT TERMINALS

- A. $\frac{3}{4}$ in. and one (1) in. aluminum threaded vent terminal with 16 x 16 mesh 0.018 gauge stainless steel screen.
- B. $1\frac{1}{4}$ in. to 4 in. standard pipe threaded elbow with 12 x 12 mesh stainless steel screen.
1. Equal to Upsco Inc.
- C. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, 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: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.



- e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
- 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.11 VALVES

A. Manual Shut-off Valves Inside Building.

- 1. Manufacturer:
 - a. **Nordstrom.**
 - b. **Fisher**
 - c. **Grinnel**
- 2. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - a. CWP Rating: 125 psig.
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - d. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
 - e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - f. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
 - g. Threaded cast iron body, 125 PSIG WOG.
- 3. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - a. CWP Rating: 125 psig.
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - c. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
 - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 - e. 2½ in. to 4-in.: Flanged cast iron body lubricated tapered plug type, 175 psig WOG.
 - f. 6 in. and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated.
- 4. Provide 2 wrenches for each size used.
 - a. Attach wrench to each valve.

B. Ball Valves

- 1. Manufacturer:



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- a. **Contromatic.**
 - b. **Cornbraco**
 - c. **NIBCO**
2. On local branches three inches and smaller, provide threaded three piece full port wafer-type ball valve with bronze body, ball stem, Teflon seats, and level handles, 300 psig WOG.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. 2 inch and smaller: Threaded brass ball valves with full port TFE seats and blowout proof stem, 600 psig WOG.
 2. Manufacturers:
 - a. **BrassCraft.**
 - b. **Conbraco.**
 - c. **NIBCO.**
 3. Body: Bronze, complying with ASTM B 584.
 4. Ball: Chrome-plated bronze.
 5. Stem: Bronze; blowout proof.
 6. Seats: Reinforced TFE; blowout proof.
 7. Packing: Threaded-body packnut design with adjustable-stem packing.
 8. Ends: Threaded, flared, or socket.
 9. CWP Rating: 600 psig.
 10. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 11. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Bronze Plug Valves: MSS SP-78.
1. Manufacturers:
 - a. **Hammond.**
 - b. **Lee Brass Company.**
 - c. **NIBCO.**
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, or flanged.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.



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8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.
1. Manufacturers:
 - a. **McDonald.**
 - b. **Mueller Co.**
 - c. **Xomox Corporation.**
 2. Body: Cast iron, complying with ASTM A126, Class B.
 3. Plug: Bronze or nickel-plated cast iron.
 4. Seat: Coated with thermoplastic.
 5. Stem Seal: Compatible with natural gas.
 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. Operator: Square head or lug type with tamperproof feature where indicated.
 8. Pressure Class: 125 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Cast Lubricated Plug Valves Inside Building:
1. 2-inch and smaller: Cast iron body, threaded, equal to **Nordstrom Valves, Inc.** Figure 114.
 2. 2½ inch to 4-inch: Flanged cast iron body lubricated tapered plug type, 175 psig WOG, equal to **Nordstrom Valves, Inc.** Figure 115.
 3. 6 inch and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated, equal to **Nordstrom Valves, Inc.** Figure 165.
 4. Valves 2 ½ inch and larger shall be flanged.
 5. Provide 2 wrenches for each size used.
 6. Attach wrench to each valve.
 7. Gas Cocks:
 - a. Gas cocks shall be for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.
 - b. Gas cocks shall be Figure 10596 as manufactured by **A.Y. McDonald Mfg. Co.**, or Series 52 as manufactured by **Conbraco Industries, Inc.**
 - c. Gas cocks shall only be used on piping 1 inch and smaller.
- G. Valves Underground (Curb Type)



1. Provide welding end steel body tapered lubricated plug type with iron plug high head extension.
 - a. 2 inch to 4 inch: 200 psig WOG, equal to Nordstrom No. 1943.
 - b. 6 inch and larger: 275 psig WOG, equal to Nordstrom No. 4185.
2. Provide with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS. Provide two operating wrenches.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.12 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers:
 - a. **Pacific Seismic Products, Inc.**
 - b. **Quake Defense, Inc.**
 - c. **Strand Earthquake.**
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 60 psi.
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 inches and smaller; flanged for valves NPS 2-1/2 inches and larger.

2.13 GAS SAFETY SHUTOFF VALVES

- A. Gas safety shut-off valves shall be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves shall be provided with a NEMA 4 enclosure modified for Class I, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 V AC., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage



standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT"

- B. Gas safety shut-off valves 2 inches and smaller shall be threaded, 2 1/2 inches and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.
 - 1. Gas safety shut-off valves 2 inches and smaller
 - a. Manufacturer:
 - 1) **Maxon Corporation Series 808.**
 - 2) **Or Approved Equal.**
 - 2. 2 1/2 inches and larger. All valves shall be provided with trim package 1-1.
 - a. Manufacturer:
 - 1) **Maxon Corporation Series 808-CP.**
 - 2) **Or Approved Equal.**
- C. Gas safety shut-off valves shall be installed in the following locations:
 - 1. On the firm gas line downstream of its meter and before any branch take-offs.
- D. Gas safety shut-off valves shall be wired to the gas leak detection system and shall function to shut off all gas supply to the building upon:
 - 1. Action of the gas leak detection system (alarm condition), and,
 - 2. Loss of normal electrical power.

2.14 GAS TENANT METERS

- A. Body and cover:
 - 1. Die cast aluminum alloy factory painted.
- B. Temperature compensation
 - 1. Bi-metallic element that automatically corrects changes in gas temperature.
- C. Gas Meter Register
 - 1. UV stabilized clear polycarbonate index box to measure in cubic feet.
 - 2. Gas register transmitter for remote reading to the building automation system.
- D. Manufacturers:
 - 1. **Equimeter.**
 - 2. **Sensus.**
 - 3. **American Meter.**



2.15 SLEEVES

- A. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.16 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. **Advance Products & Systems, Inc.**
 - b. **Calpico Inc.**
 - c. **Metraflex Company.**
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.17 MECHANICAL GAS SLEEVES

- A. Carbon steel, zinc chromate bolts and nuts with corrosion inhibiting coating.
- B. Seal material EPDM, black in color.
- C. Pressure plates of reinforced nylon polymer.
- D. Equal to Thunderline Link Seal Model 'C'.

2.18 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.



1. Finish: Polished chrome-plated or rough brass.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.19 PRESSURE GAUGES

- A. 4½ in. diameter, black enamel coated steel case ring with shatterproof glass, ½ in. bronze bellows with brass socket, blow out on back of case, ¼ in. bottom outlet connection, similar to **Tretrice** No. 860 or **Weksler Instruments Corp.** No. BL14-PWE4-LWXX with 0 to 27 in. of water column dial, brass pressure snubber and brass tee-handle cock.
- B. Locate pressure gauges on inlet and outlet of gas booster pressure pump, at farthest point in system and as noted.

2.20 REMOTE METER READING EQUIPMENT

- A. Electronic hard wired transmitter to provide gas consumption readings for every individual tenant and concession to the building management system.

2.21 CATHODIC PROTECTION

- A. Provide a complete electrically isolated, cathodic protection system for entire length of underground gas line, including all components, suitable for temperatures and pressures involved.
- B. Prior to installation, conduct a corrosion site survey using a qualified corrosion engineer to evaluate soil conditions and establish system requirements.
- C. System shall be the sacrificial magnesium anode type with 17 lb anodes, spacing based upon soil resistivity readings, with a maximum spacing of 300 feet Pack anodes in permeable cloth bag in backfill: 75% ground hydrated gypsum, 20% powdered Wyoming bentonite, 5% anhydrous sodium sulfate.
- D. Magnesium anodes shall be high current type with magnesium wall having the following composition:
 1. Aluminum: 5.3 to 6.7%.
 2. Manganese: 0.15% minimum.
 3. Zinc: 2.5 to 3.5%.
 4. Silicone: 0.3% maximum.



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5. Copper: 0.02% maximum.
 6. Nickel: 0.003% maximum.
 7. Iron: 0.003% maximum.
 8. Other impurities: 0.3% maximum.
 9. Magnesium: Remaining.
- E. Anodes shall be cast with perforated galvanized steel strap core. One end of anode shall be recessed so one end of strap is accessible for lead wire connection. Anode lead wires shall be 25 feet long, silver soldered to strap core and with a minimum 1 turns of wire at connection. Fill anode recess connection with electrical potting compound. Conductors shall be No. 12 AWG Type TW copper wire.
- F. Connectors shall be brazing type elements for mechanically bonding conductors to steel pipe. Moisture-proof all connections to piping. Splices shall be made with split bolt compression connectors and suitable protection tape.
- G. For pipe installed in sleeves, provide insulators, equal to Maloney Model 57, spaced 10-feet on centers, installed in accordance with manufacturer's recommendations. Provide insulating coupling for pipe penetrating building wall.
- H. Provide test stations housed in electrical conduit terminated in cast iron, waterproof junction boxes at ground surface. Embed in 12-inches x 12-inches x 6-inches concrete marker.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. Field verify that connection to existing piping systems sizes, locations, and invert are as required.
- F. Establish elevations of buried piping with not less than allowed per code.
- G. Establish minimum separation of from other piping services in accordance with code.

3.2 NATURAL FUEL GAS SYSTEMS INSTALLATION

- A. Install piping free from traps and with drain pocket consisting of nipple and cap at low points for inside building and drip pot for underground piping.



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- B. Install shut-off valves at connection to each piece of equipment. Provide union or right and left nipple and coupling at equipment side of individual shut-off valve.
- C. Install gas meter in a well ventilated and accessible location. Gas meter room (3 hr. rated enclosure) with explosion-proof fixtures.
- D. Threaded Joints:
 - 1. Make-up joints with U.L. listed gas resistant Teflon tape or Teflon paste, suited for gas piping.
- E. Provide a two elbow-swing on all branches taken from a riser.
- F. Provide valve tags for piping systems indicating the operating system pressure.
- G. Color code piping at different pressures within the gas meter room. Paint fifteen (15) to five (5) psi system brown and reduced pressure piping yellow.
- H. Welders must be qualified in accordance with either API 1104 or ASME IX Boiler and Pressure Vessel Code and as required by local code.
- I. Provide sign on the exterior of the gas meter door shall be provided with bold lettering at least 1 in. high and properly spaced with lettering and background in contrasting colors reading "Gas Meter Room - No Storage Permitted."
- J. Support horizontal gas piping as follows:
 - 1. ½ in. - 6 ft. on center.
 - 2. ¾ in. or 1 in. - 8 ft. on center.
 - 3. 1¼ in. or larger - 10 ft. on center.
 - 4. Vertical piping at every floor.
- K. Provide remote meter reading communication wiring to connect to building automation system. Wire gauge per manufacturer recommendation for distance required.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 22 inches below finished grade as required.
 - 1. If natural-gas piping is installed less than 72 inches below finished grade, install it in ductile iron pipe containment conduit.
 - 2. Coordinate with site paving contractor for finished grade location.
 - 3. Protect exterior underground pipe from damage due to heavy equipment traffic during construction.
- C. Install underground, PE, natural-gas piping according to ASTM D2774.



- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- G. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- H. Install pressure gauge upstream and downstream from each service regulator as required.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
 - 1. Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.



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- c. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - d. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw.
 - e. Piping in Equipment Rooms: One-piece, cast-brass type.
 - f. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials as required.
- I. Verify final equipment locations for roughing-in.
- J. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- K. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
- 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- L. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- M. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- N. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
- 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing horizontally through partitions or walls does not require striker barriers.
 - 3. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping embedded in concrete walls or partitions.



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- O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- P. Connect branch piping from top or side of horizontal piping.
- Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- R. Do not use natural-gas piping as grounding electrode.
- S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- T. Install pressure gauge upstream and downstream from each line regulator as required.

3.5 SERVICE METER ASSEMBLY INSTALLATION

- A. Install service-meter assemblies aboveground, on concrete bases.
- B. Install metal shutoff valves upstream from service regulators.
- 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.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies as required.
- H. Install meters on full size gas headers.

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.



3.7 HANGER & SUPPORT INSTALLATION

- A. Install seismic restraints on piping as required.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
- C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

END OF SECTION 23 11 23