SECTION 23 1126

LIQUEFIED-PETROLEUM GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aboveground pipe and fittings.

B. Joining materials.

C. Flexible connectors.

D. Manual gas shut-off valves.

E. Line Pressure regulators.

F. Appliance Pressure regulators.

1.2 RELATED SECTIONS

A. Pipe assembly: Section 23 0500.

B. Generators: Division 26.

C. Painting: Division 09.

1.3 UTILITY CONNECTION

A. New propane service will be installed by the utility provider. Make arrangements for, and have this service installed, at the appropriate scheduled time. Submit the bill upon completion of this part of the work. Owner will pay the utility company.

1.4 REFERENCES

A. ANSI

1. ANSI LC1: Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
2. ANSI Z21.18: Gas Appliance Pressure Regulators.
3. ANSI Z21.24: Connectors for Gas Appliances.
4. ANSI Z21.69: Connectors for Moveable Gas Appliances.
5. ANSI Z21.75: Connectors for Outdoor Gas Appliances and Manufactured Homes
6. ANSI Z21.80: Line Pressure Regulators.
7. ANSI Z223.1/NFPA 54: National Fuel Gas Code.

B. ASME

1. ASME B1.20.1: Pipe Threads, General Purpose, Inch.
2. ASME B16.3: Malleable Iron Threaded Fittings: Classes 150 and 300.
3. ASME B16.5: Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24 Metric/Inch Standard.
4. ASME B16.20: Metallic Gaskets for Pipe Flanges.
5. ASME B16.39: Malleable Iron Threaded Pipe Unions, 1111111Classes 150, 250, and 300.


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6. ASME B18.2.1: Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

C. ASTM

1. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
5. ASTM B88: Standard Specification for Seamless Copper Water Tube.
6. ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
8. ASTM D 2513: Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
9. ASTM D2657: Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
10. ASTM D 2683: Socket-Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
11. ASTM D 2774: Practice for Underground Installation of Thermoplastic Pressure Piping.
12. ASTM D 3261: Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings.

D. AWS

1. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1: Structural Welding Code Package for Steel and Aluminum.
3. AWS D10.12: Guide for Welding Mild Steel Pipe.

E. UL

1. UL 536: Standard for Flexible Metallic Hose

1.5 SUBMITTALS

A. Product data:

1. Pipe, fitting, and joining materials.
2. Flexible connectors.
3. Manual gas shut-off valves.
4. Pressure regulators

   a. Submit documentation showing that the regulator is suitable for the anticipated inlet pressure range, the required inlet pressure of the associated appliance, and the minimum and maximum gas flow rate of the associated appliance.
   b. Submit any associated accessories including vent protectors and vent limiters.
   c. Pressure regulators serving boilers and generators shall be submitted with that equipment, furnished by the boiler or generator manufacturer, and shall be selected by the boiler or generator manufacturer to serve the equipment based on the pressure inlet conditions at the site. Regulators shall meet the requirements of this specifications section.


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B. Certifications:

1. Test and approval of gas piping installation by the authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. UL label and local testing (if required): As specified in Section 23 0500, Common Work Results for HVAC.

D. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

1.7 REGULATORY REQUIREMENTS

A. Installation of gas piping shall meet requirements of the authority having jurisdiction, the gas supplier for gas service, and NFPA 54.

B. Upon completion of the work, the piping shall be tested as required by inspection authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

C. Protect stored PE pipes and valves from direct sunlight.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following:

1. Manual gas shut-off valves:

a. Apollo Valves.
b. Milwaukee Valve Co.
c. Nibco.
d. Stockham Valve & Fittings.
e. Walworth Co.
f. Watts Regulator.


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2. Pressure regulators:

    a. American Meter Company.
    b. Belgas.
    c. Eclipse.
    d. Equimeter.
    e. Fisher Controls.
    f. Itron
    g. Maxitrol
    h. Pietro Fiorentini.
    i. Sensus.

3. Equipment flexible connectors:

    a. Flex-hose Company
    b. Mason Industries, Inc.
    c. Metraflex

## 2.2 ABOVEGROUND PIPE AND FITTINGS

A. Pipe: ASTM A53, black steel, Schedule 40:

1. NPS 1.5 (DN 40) and smaller: Type F (continuous weld pipe).
2. NPS 2 (DN 50) and larger: Type E (electric resistance welded).

B. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

C. Wrought-Steel Welding Fittings: ASTM A234 for butt welding and socket welding.

D. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

E. 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:

1. Material Group: 1.1.
2. End Connections: Threaded or butt welding to match pipe.
3. Lapped Face: Not permitted underground.
4. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
5. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

## 2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for liquefied-petroleum gas.

B. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 degrees F (540 degrees C) complying with AWS A5.8. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.


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## 2.4 FLEXIBLE CONNECTORS

A. Equipment flexible connectors (UL 536):

1. Comply with UL 536, including flexure cycle testing.
2. Corrugated Type 321 stainless-steel hose with single-braid Type 304 stainless steel exterior.
3. Working pressure: Minimum 50 psig (345 kPa).
4. Connections: Flanged or threaded.
5. Length: 36 inches (914 mm) unless otherwise noted on the drawings.
6. Basis of design: Flex-Hose Inc. UltraFuelFlex Braided Metal Connector.

## 2.5 MANUAL GAS SHUT-OFF VALVES

A. NPS 2.5 (DN 65) through NPS 6 (DN150): Non-lubricated eccentric plug valves, MSS SP-78, UL Listed.

1. Body: Cast iron.
2. Plug: cast iron.
3. Stem Seal: Compatible with liquefied-petroleum gas.
4. Plug Seal: Resilient Nitrile-Butadiene (NBR)
5. Ends: flanged
6. Operator: Square head or lug type with lever handle.
7. Pressure rating: 175 psig (1208 kPa) WOG
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for liquefied-petroleum gas service with "WOG" indicated on valve body.
10. Basis of design: SMG Key Port series 400 fig. 425.

B. NPS 2.5 (DN 65) through NPS 10 (DN 250): Cast iron ball valve, MSS SP-72

1. Body: Epoxy-coated cast iron, ASTM A126, Class B
2. Ball: cast iron / PFA (Teflon) fused or stainless steel.
3. Stem: Stainless steel, blow-out proof
4. Stem seal: PTFE.
5. Seats and body seals: PTFE.
6. Plug Seal: Resilient Nitrile-Butadiene (NBR)
7. Ends: flanged
8. Operator: Lever handle.
9. Pressure rating: 200 psig (1380 kPa) WOG
10. Service: Suitable for liquefied-petroleum gas service with "WOG" indicated on valve body.
11. Basis of design: American Valve, Inc. Model 4000.

## 2.6 LINE PRESSURE REGULATORS

A. General: Regulators shall be selected to meet the following criteria at a minimum.

1. Provide required capacity at both the minimum and maximum expected inlet pressure.
2. Provide required outlet pressure.
3. React quickly enough to support a change from no flow to required flow upon startup.

B. Line pressure regulators with internal relief: Adjustable, comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum, with removable threaded cap to allow spring adjustment.
2. Springs: Zinc-plated steel; interchangeable.


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3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, direct-operated, regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure, or 5 inches w.g. (1.2 kPa) above design discharge pressure (whichever is greater) at shutoff.
9. Atmospheric vent: Threaded vent connection on the side of the diaphragm that communicates with the atmosphere.
10. Internal relief valve: The regulator shall incorporate an adjustable internal relief valve.

    a. The relief valve shall be set to vent excess pressure from the side of the diaphragm that communicates with the regulator discharge pressure to the side of the diaphragm that communicates with the atmosphere.
    b. If the discharge pressure exceeds the force of the set point spring of the relief valve, the diaphragm rises and opens the relief valve. Gas then flows from the discharge pressure side of the diaphragm to the side of the diaphragm that communicates with the atmosphere until the discharge gas pressure drops to the relief valve set point.
    c. The relief pressure must be set above the discharge set point pressure of the regulator, and below any appliance limit switch pressure which may cause nuisance trips for the appliance.

C. Line Pressure Regulators: Adjustable, comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum, with removable threaded cap to allow spring adjustment.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, direct-operated, regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure, or 5 inches w.g. (1.2 kPa) above design discharge pressure (whichever is greater) at shutoff.
9. Atmospheric vent: Threaded vent connection on the side of the diaphragm that communicates with the atmosphere.

## 2.7 APPLIANCE PRESSURE REGULATORS

A. General: Regulators shall be selected to meet the following criteria at a minimum.

1. Provide required capacity at both the minimum and maximum expected inlet pressure.
2. Provide required outlet pressure.
3. React quickly enough to support a change from no flow to required flow upon startup.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.


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3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Single-port, direct-operated, regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Atmospheric vent: Threaded vent connection on the side of the diaphragm that communicates with the atmosphere.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

A. Install piping as indicated on the drawings, in accordance with the regulations of the local authority and local gas utility company, and in accordance with installation and testing requirements of Section 23 0500.

B. Examine roughing-in for liquefied-petroleum gas piping system to verify actual locations of piping connections before equipment installation.

C. Install piping free of sags and bends.

D. Install fittings for changes in direction and branch connections.

E. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

F. Take branches from horizontal runs from side or top of such runs. A tee shall be placed at the bottoms of risers in gas piping. Bottom of tee shall be provided with a six-inch-long nipple and cap the same size as riser. When riser is concealed, the cap shall project through wall to be accessible and shall be properly marked with engraved plastic nameplate, "DANGER, GAS, CLEANOUT". Red background with white letters.

G. Install pressure gage downstream from each service regulator.

H. Purge gas lines to equipment when the gas supply is turned on.

3.2 ABOVEGROUND PIPING INSTALLATION

A. Indoor piping installation:

1. Joints:

   a. Provide welded or threaded joints for piping NPS 1.5 (DN 40) or smaller
   b. Provide welded joints for piping NPS 2 (DN 50) and larger.

2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
3. Conceal pipe in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
4. Prohibited Locations:

   a. Do not install liquefied-petroleum gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install liquefied-petroleum gas piping in solid walls or partitions.


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5. Install exposed piping and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically otherwise indicated.
6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
7. Drips and Sediment Traps: Install liquefied-petroleum gas piping at uniform grade down toward drip and sediment traps. Install drips at points where condensate may collect, including service-meter outlets.

    a. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
    b. 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 6 inches (150 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

B. Outdoor piping installation:

1. Joints: Welded.

C. All aboveground pipe and fittings shall be painted OSHA yellow**.**

3.3 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for liquefied-petroleum gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.


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## 3.4 EQUIPMENT CONNECTIONS

A. General:

1. Install liquefied-petroleum gas piping electrically continuous, and bonded to equipment grounding conductor of the circuit powering the equipment according to NFPA 70. Do not use liquefied-petroleum gas piping as a grounding electrode.
2. Install piping adjacent to equipment to allow service and maintenance.
3. Connect piping to equipment using manual gas shutoff valves and unions. Install valve near each piece of equipment. Install union between valve and equipment. Unions are not required at flanged connections.

B. Generators:

1. Provide a line pressure regulator with internal relief where the service pressure is in excess of the appliance inlet pressure range.
2. Provide a minimum of 10 feet (3 meters) of gas piping between the regulator and the downstream equipment flexible connector (UL 536). Provide elbows and additional piping as needed to accommodate the required length. Provide the piping a minimum of two pipe sizes larger than the regulator outlet or generator inlet connection, whichever is larger, in order to create a reservoir of gas a minimize pressure fluctuations. Provide reducers and increasers as required.
3. Provide an equipment flexible connector (UL 536).

## 3.5 MANUAL GAS SHUT-OFF VALVE INSTALLATION

A. Provide a valve at house side of each gas meter.

B. Provide valves in branch lines as indicated on drawings.

C. Provide valves in each connection to equipment, adjacent to the equipment.

D. Provide a shut-off valve upstream at each automatic gas safety shut-off valve.

E. Provide a shut-off valve upstream at each regulator.

F. Install valves readily accessible for operation and maintenance, with ample clearance for turning wheel handles or operators.

G. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve. Unions are not required at flanged connections.

## 3.6 PRESSURE REGULATOR INSTALLATION

A. Provide a shut-off valve and a capped tee fitting suitable for connection to a pressure gauge upstream of each regulator.

B. Provide a tee fitting with a pressure gauge with associated shut-off valve approximately 10 pipe diameters downstream of each regulator.

C. Provide a union within one foot on either side of each regulator.

D. Provide each regulator's vent connection, whether provided with the equipment served, part of an interior gas service regulators (including overpressure protection devices), or provided separately, with a termination as follows:


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1. Exterior applications: Provide one of the following:

    a. Vent pipe: Provide a vent pipe from the vent connection to a safe location outside of the building.
    b. Vent protector: Provide a vent protector, listed for use with the regulator, to protect the vent connection from debris and moisture. Provide the regulator at an elevation and location not subject to flooding or snow cover.

E. Regulator performance verification:

1. Verify the proper springs are provided for the inlet and outlet pressures present.
2. Adjust the discharge pressure setting of each regulator.
3. Adjust the relief pressure setting of each relief device.
4. Observe appropriate discharge pressure control through startup, shut-down, and the entire firing range of the associated equipment.

## 3.7 PAINTING

A. Comply with requirements in Section 23 0500 "Common Work Results for HVAC" and Division 09 for painting interior and exterior liquefied-petroleum gas piping.

B. Prime and paint exposed interior piping OSHA yellow. Do not paint flexible connectors.

C. Prime and paint exterior above-grade piping, and valves, regulators, meters and piping specialties OSHA yellow. Do not paint flexible connectors.

END OF SECTION


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