
USACE / NAVFAC / AFCEC / NASA UFGS-33 11 23 (November 2009)

Preparing Activity: NAVFAC Superseding
UFGS-33 11 23 (August 2008)
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2017

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11/09

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SECTION 33 11 23

NATURAL GAS AND LIQUID PETROLEUM PIPING 11/09

NOTE: This guide specification covers the requirements for exterior and interior fuel gas piping.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: This guide specification is intended for use when specifying buried polyethylene piping of up to 200 mm 8 inches in nominal pipe size at pressures and other conditions governed by ASME B31.8, "Gas Transmission and Distribution Piping Systems," and aboveground steel piping both outside (up to 1.50 meters 5 feet beyond exterior walls) and within buildings in compliance with NFPA 54, "Fuel Gas Piping."

NOTE: The following information shall be shown on the project drawings:

1. Layout and location of piping.

2. Location of appurtenances, valves, etc.

3. Details of method of mounting piping.

4. Capacity of pressure regulators

5. Location and capacity of LP gas containers.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA ANSI B109.1 (2000) Diaphragm-Type Gas Displacement Meters (Under 500 cubic ft./hour Capacity)

AGA ANSI B109.2 (2000) Diaphragm-Type Gas Displacement Meters (500 cubic ft./hour Capacity and Over)

AGA ANSI B109.3 (2000) Rotary-Type Gas Displacement Meters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.41/CSA 6.9 (2014) Quick-Disconnect Devices for Use with Gas Fuel Appliances

ANSI Z21.45 (1995) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances

ANSI Z21.69/CSA 6.16 (2009; Addenda A 2012; R 2014) Connectors for Movable Gas Appliances

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 25-16 (2016) Earthquake-Activated Automatic Gas Shutoff Devices

ASME INTERNATIONAL (ASME)

ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.20.1 (2013) Pipe Threads, General Purpose (Inch)

ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.33 (2012) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psi, Sizes NPS 1/2 - NPS 2

ASME B16.38 (2012) Large Metallic Valves for Gas Distribution (Manually Operated, NPS 2 1/2 to 12, 125 psig Maximum)

ASME B16.39 (2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.40 (2013) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B31.8 (2014; Supplement 2014) Gas Transmission and Distribution Piping Systems

ASME BPVC SEC VIII D1 (2015) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A193/A193M (2016) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and

Other Special Purpose Applications

ASTM A194/A194M	(2016a) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM D2513	(2014; E 2014) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2683	(2014) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2015) National Fuel Gas Code
NFPA 58	(2017) Liquefied Petroleum Gas Code

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1981	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
49 CFR 195	Transportation of Hazardous Liquids by Pipeline

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to

this section, with additions and modifications specified herein.

1.3 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Valve box

Pressure regulator

Gas equipment connectors
Valves
Warning and identification tape
Risers
Transition fittings
Gas meter

[LPG containers and accessories]

SD-07 Certificates

Welder's qualifications
PE welder's qualifications
Welder's identification symbols

SD-08 Manufacturer's Instructions

PE pipe and fittings
Submit manufacturer's installation instructions and
manufacturer's visual joint appearance chart.

1.4 QUALITY ASSURANCE

1.4.1 Welder's Qualifications

Comply with ASME B31.8. The steel welder shall have a copy of a certified ASME B31.8 qualification test report. The PE welder shall have a certificate from a PE pipe manufacturer's sponsored training course. Contractor shall also conduct a qualification test. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Affix symbols immediately upon completion of welds. Welders making defective welds after passing a qualification test shall be given a requalification test and, upon failing to pass this test, shall not be permitted to work this contract.

1.4.2 PE Welder's Qualifications

Prior to installation, Contractor shall have supervising and installing personnel trained by a PE pipe manufacturer's sponsored course of not less than one week duration, or present proof satisfactory to the Contracting Officer that personnel are currently working in the installation of PE gas distribution lines.

1.4.3 Safety Standards

49 CFR 192 [and 49 CFR 195].

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store plastic pipe and fittings carefully. Plug or cap pipe ends during transportation or storage to minimize dirt and

moisture entry. Do not subject to abrasion or concentrated external loads. Discard PE pipe sections and fittings that have been damaged.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Conform to NFPA 54 and with requirements specified herein. Supply piping to appliances or equipment shall be at least as large as the inlets thereof.

2.2 PIPE AND FITTINGS

2.2.1 Aboveground and Within Buildings and Vaults

NOTE: For steam electric generation stations, industrial and institutional plants, and central heating plants, use Schedule 80 black steel piping in accordance with ANSI B31.1 for threaded joints.

- a. Pipe: Black steel in accordance with ASTM A53/A53M, Schedule [40] [80], threaded ends for sizes 50 mm 2 inches and smaller; otherwise, plain end beveled for butt welding.
- b. Threaded Fittings: ASME B16.3, black malleable iron.
- c. Socket-Welding Fittings: ASME B16.11, forged steel.
- d. Butt-Welding Fittings: ASME B16.9, with backing rings of compatible material.
- e. Unions: ASME B16.39, black malleable iron.
- f. Flanges and Flanged Fittings: ASME B16.5 steel flanges or convoluted steel flanges conforming to ASME BPVC SEC VIII D1. Flange faces shall have integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

2.2.2 Underground Polyethylene (PE)

PE pipe and fittings are as follows:

- a. Pipe: ASTM D2513, 690 kPa (gage) 100 psig working pressure, Standard Dimension Ratio (SDR), the ratio of pipe diameter to wall thickness, 11.5 maximum.
- b. Socket Fittings: ASTM D2683.
- c. Butt-Fusion Fittings: ASTM D2513, molded.

2.2.3 Risers

Manufacturer's standard riser, transition from plastic to steel pipe with 0.18 to 0.30 mm 7 to 12 mil thick epoxy coating. Use swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Provide [remote bolt-on or bracket] [or] [wall-mounted] riser supports [as indicated].

2.2.4 Transition Fittings

NOTE: Choose the applicable options from the following.

- [a. Steel to Plastic (PE): As specified for "riser" except designed for steel-to-plastic with tapping tee or sleeve. Coat or wrap exposed steel pipe with heavy plastic coating.]
- [b. Plastic to Plastic: [Manufacturer's standard bolt-on (PVC to PE) plastic tapping saddle tee, UL listed for gas service, rated for 690 kPa (gage) 100 psig, and O-ring seals.] [Manufacturer's standard slip-on PE mechanical coupling, molded, with stainless-steel ring support, O-ring seals, and rated for 1035 kPa (gage) 150 psig gas service.] [Manufacturer's standard fused tapping (PE-to-PE) tee assembly with shut-off feature.]]

2.3 SHUTOFF VALVES, BELOW GROUND

2.3.1 [Metallic Ball Valves

NOTE: Choose this paragraph or the paragraph below entitled "PE Ball or Plug Valves."

[ASME B16.33] [or] [ASME B16.38] corrosion-resisting steel, with threaded or flanged ends. Provide polytetrafluoroethylene (PTFE) seats.

]2.3.2 [PE Ball or Plug Valves

NOTE: PE ball or plug valves: Class 1 location means not more than 10 living units, homes and separate living units within apartment buildings, along a 1600 meters one mile length of pipeline; Class 2 location means not more than 46 living units, along a 1600 meters one mile length of pipeline; Class 3 location means not more than 20 persons normally congregating in any one building or outdoor location; and Class 4 location means any location where Class 1 to 3 population densities are exceeded. The Class 4 class factor also applies where there are buildings of more than three stories.

ASME B16.40 and ASTM D2513, Class C materials (PE 2306 or PE 3406), strength rating of Class [1 location with class factor of 0.32] [2 location with class factor of 0.25] [3 location with class factor of 0.25] [4 location with class factor of 0.20], and SDR matching PE pipe dimensions and working pressure.

]2.4 VALVES, ABOVEGROUND

[Provide lockable valves where indicated.]

2.4.1 Shutoff Valves, Sizes Larger Than 50 Millimeters 2 Inches

NOTE: Choose one of the options below.

**NOTE: Do not use cast-iron material for valve body
or gas-meter body in seismic zones 3 and 4.**

[[Cast-iron] [or] [steel] body ball valve with flanged ends in accordance with ASME B16.38. Provide PTFE seats.]

[Cast-iron body plug valve in accordance with ASME B16.38, nonlubricated, wedge-mechanism or tapered lift plug, and flanged ends.]

2.4.2 Shutoff Valves, Sizes 50 Millimeters 2 Inches and Smaller

NOTE: Choose one of the options below.

[[Bronze] [Steel] body ball valve in accordance with ASME B16.33, full port pattern, reinforced PTFE seals, threaded ends, and PTFE seat.]

[[Bronze] [Steel] body plug valve in accordance with ASME B16.33, straightway, taper plug, regular pattern with a port opening at least equal to the internal pipe area or round port full bore pattern, non-lubricated, PTFE packing, flat or square head stem with lever operator, 860 kPa (gage) 125 psig rating, threaded ends.]

2.4.3 Pressure Regulator

Self-contained with spring-loaded diaphragm pressure regulator, kPa to mm psig to inches water reduction, pressure operating range as required for the pressure reduction indicated, volume capacity not less than indicated, and threaded ends for sizes 50 mm 2 inches and smaller, otherwise flanged.

2.4.4 Earthquake Automatic Gas Shutoff Valve

**NOTE: Provide this earthquake protective feature
primarily for seismic zones 3 and 4.**

ASCE 25-16 and UL listed or AGA listed or International Association of Plumbing and Mechanical Officials (IAPMO) listed. The valve may be either pendulum or ball construction with [remote [, pneumatic] [electronic] [or] [electric]] actuator.

2.5 GAS METER

**NOTE: Do not use cast-iron material for valve body
or gas-meter body in seismic zones 3 and 4.**

[AGA ANSI B109.1] [AGA ANSI B109.2] [AGA ANSI B109.3] [pipe] [pedestal]

mounted, [diaphragm] or [bellow] [style], [cast-iron] [enamel coated steel] [aluminum] case. Provide combined register totalizer, water escape hole in housing, and means for sealing against tampering.

2.6 GAS EQUIPMENT CONNECTORS

- a. Flexible Connectors: ANSI Z21.45.
- b. Quick Disconnect Couplings: ANSI Z21.41/CSA 6.9.
- c. Semi-Rigid Tubing and Fittings: ANSI Z21.69/CSA 6.16.

2.7 VALVE BOX

Provide [street valve box with cast-iron cover and two-piece 130 mm 5 1/4 inch shaft-slip valve box extension] [rectangular concrete valve box, sized large enough for removal of valve without removing box]. Cast the word "Gas" into the box cover. Use valve box for areas as follows:

- a. Roads and Traffic Areas: Heavy duty, cast iron cover.
- b. Other Areas: Standard duty, concrete cover.
- [c. Airfields and Special Loadings: As detailed.]

2.8 CASING

Where indicated at railroad or other crossing, provide ASTM A53/A53M, galvanized pipe, Schedule 40 [, with extruded polyethylene coating].

2.9 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

Provide detectable aluminum-foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 75 mm 3 inch minimum width, color-coded yellow for natural gas, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED GAS PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.10 HANGERS AND SUPPORTS

MSS SP-58, as required by MSS SP-69.

2.11 WELDING FILLER METAL

ASME B31.8.

2.12 PIPE-THREAD TAPE

Antiseize and sealant tape of polytetrafluoroethylene (PTFE).

2.13 BOLTING (BOLTS AND NUTS)

Stainless steel bolting; ASTM A193/A193M, Grade B8M or B8MA, Type 316, for bolts; and ASTM A194/A194M, Grade 8M, Type 316, for nuts. Dimensions of bolts, studs, and nuts shall conform with ASME B18.2.1 and ASME B18.2.2 with

coarse threads conforming to ASME B1.1, with Class 2A fit for bolts and studs and Class 2B fit for nuts. Bolts or bolt-studs shall extend through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Bolts shall have American Standard regular square or heavy hexagon heads; nuts shall be American Standard heavy semifinished hexagonal.

2.14 GASKETS

Fluorinated elastomer, compatible with flange faces.

2.15 IDENTIFICATION FOR ABOVEGROUND PIPING

MIL-STD-101 for legends and type and size of characters. For pipes 19 mm 3/4 inch od and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 19 mm 3/4 inch od, provide brass identification tags 40 mm 1 1/2 inches in diameter with legends in depressed black-filled characters.

2.16 [(LIQUEFIED PETROLEUM GAS) LPG CONTAINERS AND ACCESSORIES

NOTE: The maximum size permitted under DOT specifications is 0.50 cubic meter 1,000 pounds water capacity. Fuse plugs may be used in addition to the spring-loaded safety relief valves for aboveground ASME containers of 4 1/2 cubic meters 1,200 gallons water capacity or less.

NFPA 58, [DOT] [or] [ASME] containers with appurtenances, system working pressure, minimum design pressure, that is LPG vapor pressure at 38 degrees C 100 degrees F, and water capacity as indicated. Provide containers with piping and fittings, [fuse plugs], [hose and flexible hose connectors], [gas-air mixer], strainer, and marking conforming to NFPA 58.

]PART 3 EXECUTION

3.1 INSTALLATION

NOTE: To assist the designer in selecting the proper documents for a specific project, the following scope in accordance with documents is provided:

1. NFPA 54 Scope: "1.1.1 Applicability: ... Coverage of piping systems extends from the point of delivery to the connections with each gas utilization device. For other than indicated liquified petroleum gas systems, the point of delivery is the outlet of the service meter assembly, or the outlet of the service regulator or service shutoff valve when no gas meter is provided. For undiluted liquified petroleum gas systems, the point of delivery is the outlet of the

first stage pressure regulator..."

2. ASME B31.8 Scope: "802.11... This code covers the design, fabrication, installation, inspection, testing and safety aspects of operation and maintenance of gas transmission and distribution systems, including gas pipelines, gas compressor stations, gas metering and regulation stations, gas mains, and service lines up to the outlet of the customer's meter set assembly....802.14 This code does not apply to....(c) piping beyond the outlet of the customers meter set assembly..."

Install gas piping, appliances, and equipment in accordance with NFPA 54. [Install distribution piping in accordance with ASME B31.8.] [Install and store liquefied petroleum gas piping, appliances, and equipment in accordance with NFPA 58.]

3.1.1 Excavating and Backfilling

Perform excavating and backfilling of pipe trenches as specified in Section 31 00 00 EARTHWORK. Place pipe directly in trench bottom and cover with minimum 75 mm 3 inches of sand to top of pipe. If trench bottom is rocky, place pipe on a 75 mm 3 inch bed of sand and cover as above. Provide remaining backfilling. Coordinate provision of utility warning and identification tape with backfill operation. Bury utility warning and identification tape with printed side up at a depth of 305 mm 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.1.2 Piping

Cut pipe to actual dimensions and assemble to prevent residual stress. [Provide supply connections entering the buildings as indicated.] Within buildings, run piping parallel to structure lines and conceal in finished spaces. Terminate each vertical supply pipe to burner or appliance with tee, nipple and cap to form a sediment trap. To supply multiple items of gas-burning equipment, provide manifold with inlet connections at both ends.

3.1.2.1 Cleanliness

Clean inside of pipe and fittings before installation. Blow lines clear using 550 to 690 kPa (gage) 80 to 100 psig clean dry compressed air. Rap steel lines sharply along entire pipe length before blowing clear. Cap or plug pipe ends to maintain cleanliness throughout installation.

3.1.2.2 Aboveground Steel Piping

Determine and establish measurements for piping at the job site and accurately cut pipe lengths accordingly. For 50 mm 2 inch diameter and smaller, use threaded or socket-welded joints. For 65 mm 2 1/2 inch diameter and larger, use flanged or butt-welded joints.

- a. Threaded Joints: Where possible use pipe with factory-cut threads, otherwise cut pipe ends square, remove fins and burrs, and cut taper pipe threads in accordance with ASME B1.20.1. Provide threads smooth, clean, and full-cut. Apply anti-seize paste or tape to male threads portion. Work piping into place without springing or forcing. Backing

off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed. Use unions for connections to [valves] [meters] for which a means of disconnection is not otherwise provided.

- b. Welded Joints: Weld by the shielded metal-arc process, using covered electrodes and in accordance with procedures established and qualified in accordance with ASME B31.8.
- c. Flanged Joints: Use flanged joints for connecting welded joint pipe and fittings to valves to provide for disconnection. Install joints so that flange faces bear uniformly on gaskets. Engage bolts so that there is complete threading through the nuts and tighten so that bolts are uniformly stressed and equally torqued.
- d. Pipe Size Changes: Use reducing fittings for changes in pipe size. Size changes made with bushings will not be accepted.
- e. Painting: Paint new ferrous metal piping, including supports, in accordance with Section 09 90 00 PAINTS AND COATINGS. Do not apply paint until piping tests have been completed.
- f. Identification of Piping: Identify piping aboveground in accordance with MIL-STD-101, using adhesive-backed or snap-on plastic labels and arrows. In lieu of labels, identification tags may be used. Apply labels or tags to finished paint at intervals of not more than 15 meters 50 feet. Provide two copies of the piping identification code framed under glass and install where directed.

3.1.2.3 Buried Plastic Lines

Provide totally PE piping. Prior to installation, obtain printed instructions and technical assistance in proper installation techniques from pipe manufacturer. [When joining new PE pipe to existing pipe line, ascertain what procedural changes in the fusion process is necessary to attain optimum bonding.]

- a. PE Piping: Prior to installation, Contractor shall have supervising and installing personnel, certified in accordance with paragraph entitled "Welder's Qualifications." Provide fusion-welded joints except where transitions have been specified. Use electrically heated tools, thermostatically controlled and equipped with temperature indication. (Where connection must be made to existing plastic pipe, contractor shall be responsible for determination of compatibility of materials and procedural changes in fusion process necessary to attain maximum integrity of bond.)
- b. Laying PE Pipe: Bury pipe 600 mm 24 inches below finish grade [or deeper when indicated]. Lay in accordance with manufacturer's printed instructions.

3.1.2.4 Connections to Existing Pipeline

When making connections to live gas mains, use pressure tight installation equipment operated by workmen trained and experienced in making hot taps. For connections to existing underground pipeline or service branch, use transition fittings for dissimilar materials.

3.1.2.5 Wrapping

Where connection to existing steel line is made underground, tape wrap new steel transition fittings and exposed existing pipe having damaged coating. Clean pipe to bare metal. Initially stretch first layer of tape to conform to the surface while spirally half-lapping. Apply a second layer, half-lapped and spiraled as the first layer, but with spirals perpendicular to first wrapping. Use 0.025 mm 10 mil minimum thick polyethylene tape. In lieu of tape wrap, heat shrinkable 0.025 mm 10 mil minimum thick polyethylene sleeve may be used.

3.1.3 Valves

Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally. [Provide support for valves to resist operating torque applied to PE pipes.]

3.1.3.1 Pressure Regulator

Provide [plug cock] [or] [ball valve] ahead of regulator. [Install regulator outside of building and 450 mm 18 inches aboveground on riser.] [Install regulator inside building and extend a full-size vent line from relief outlet on regulator to a point outside of building.] [Install gas meter in conjunction with pressure regulator]. On outlet side of [regulator] [meter], provide a union and a 10 mm 3/8 inch gage tap with plug.

3.1.3.2 Stop Valve and Shutoff Valve

Provide stop valve on service branch at connection to main and shut-off valve on riser outside of building.

3.1.4 Pipe Sleeves

[Comply with Section 07 84 00 FIRESTOPPING.] Where piping penetrates concrete or masonry wall, floor or firewall, provide pipe sleeve poured or grouted in place. Make sleeve of steel or cast-iron pipe of such size to provide 6 mm 1/4 inch or more annular clearance around pipe. Extend sleeve through wall or slab and terminate flush with both surfaces. Pack annular space with oakum, and caulk at ends with silicone construction sealant.

3.1.5 Piping Hangers and Supports

NOTE: In seismic zone 3 or 4, provide seismic restraints in accordance with SMACNA Seismic Restraint Mnl.

Selection, fabrication, and installation of piping hangers and supports shall conform with MSS SP-69 and MSS SP-58, unless otherwise indicated. [Provide seismic restraints in accordance with SMACNA 1981.]

3.1.6 Final Connections

Make final connections to equipment and appliances using rigid pipe and fittings, except for the following:

3.1.6.1 Domestic Water Heaters

Connect with AGA-Approved semi-rigid tubing and fittings.

3.1.6.2 Kitchen Equipment

Install AGA-Approved gas equipment connectors. Connectors shall be long enough [to permit movement of equipment for cleaning] [and] [to afford access to coupling].

3.2 FIELD QUALITY CONTROL

3.2.1 Metal Welding Inspection

NOTE: To assist the designer in selecting the proper documents for a specific project, the following scope in accordance with documents is provided:

1. NFPA 54 Scope: "1.1.1 Applicability: ... Coverage of piping systems extends from the point of delivery to the connections with each gas utilization device. For other than indicated liquified petroleum gas systems, the point of delivery is the outlet of the service meter assembly, or the outlet of the service regulator or service shutoff valve when no gas meter is provided. For undiluted liquified petroleum gas systems, the point of delivery is the outlet of the first stage pressure regulator..."

2. ASME B31.8 Scope: "802.11... This code covers the design, fabrication, installation, inspection, testing and safety aspects of operation and maintenance of gas transmission and distribution systems, including gas pipelines, gas compressor stations, gas metering and regulation stations, gas mains, and service lines up to the outlet of the customer's meter set assembly....802.14 This code does not apply to....(c) piping beyond the outlet of the customers meter set assembly..."

Inspect for compliance with [NFPA 54] [and] [ASME B31.8]. Replace, repair, and then re-inspect defective welds.

3.2.2 PE Fusion Welding Inspection

Visually inspect butt joints by comparing with, manufacturer's visual joint appearance chart. Inspect fusion joints for proper fused connection. Replace defective joints by cutting out defective joints or replacing fittings. Inspect 100 percent of all joints and reinspect all corrections. Arrange with the pipe manufacturer's representative in the presence of the Contracting Officer to make first time inspection.

3.2.3 Pressure Tests

NOTE: To assist the designer in selecting the proper documents for a specific project, the following scope in accordance with documents is provided:

1. NFPA 54 Scope: "1.1.1 Applicability: ... Coverage of piping systems extends from the point of delivery to the connections with each gas utilization device. For other than indicated liquified petroleum gas systems, the point of delivery is the outlet of the service meter assembly, or the outlet of the service regulator or service shutoff valve when no gas meter is provided. For undiluted liquified petroleum gas systems, the point of delivery is the outlet of the first stage pressure regulator..."

2. ASME B31.8 Scope: "802.11... This code covers the design, fabrication, installation, inspection, testing and safety aspects of operation and maintenance of gas transmission and distribution systems, including gas pipelines, gas compressor stations, gas metering and regulation stations, gas mains, and service lines up to the outlet of the customer's meter set assembly....802.14 This code does not apply to....(c) piping beyond the outlet of the customers meter set assembly..."

Use test pressure of 1 1/2 times maximum working pressure, but in no case less than 350 kPa (gage) 50 psig. Do not test until every joint has set and cooled at least 8 hours at temperatures above 10 degrees C 50 degrees F. Conduct testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place during tests. Test system gas tight in accordance with [NFPA 54] [or] [ASME B31.8]. Use clean dry air or inert gas, such as nitrogen or carbon dioxide, for testing. Systems which may be contaminated by gas shall first be purged as specified. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from sources of air during test period. Maintain test pressure for at least 8 hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes. Provide temperature same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship $PF + 101.32 = (P1 + 101.32) (T2 + 273) / T1 + 273$ $PF + 14.7 = (P1 + 14.7) (T2 + 460) / T1 + 460$, in which "T" and "PF" represent Centigrade Fahrenheit temperature and gage pressure, respectively, subscripts "1" and "2" denote initial and final readings, and "PF" is the calculated final pressure. If "PF" exceeds the measured final pressure (final gage reading) by 3 1/2 kPa 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. In performing tests, use a test gage calibrated in 7 kPa one psi increments and readable to 3 1/2 kPa 1/2 psi.

3.2.4 System Purging

NOTE: To assist the designer in selecting the proper documents for a specific project, the following scope in accordance with documents is provided:

1. NFPA 54 Scope: "1.1.1 Applicability: ... Coverage of piping systems extends from the point of delivery to the connections with each gas utilization device. For other than indicated liquified petroleum gas systems, the point of delivery is the outlet of the service meter assembly, or the outlet of the service regulator or service shutoff valve when no gas meter is provided. For undiluted liquified petroleum gas systems, the point of delivery is the outlet of the first stage pressure regulator..."

2. ASME B31.8 Scope: "802.11... This code covers the design, fabrication, installation, inspection, testing and safety aspects of operation and maintenance of gas transmission and distribution systems, including gas pipelines, gas compressor stations, gas metering and regulation stations, gas mains, and service lines up to the outlet of the customer's meter set assembly....802.14 This code does not apply to....(c) piping beyond the outlet of the customers meter set assembly..."

After completing pressure tests, and before testing a gas contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to [NFPA 54] [and] [ASME B31.8].

-CAUTION-
Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

3.3 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

<u>Products</u>	<u>Inch-Pound</u>	<u>Metric</u>
a. [_____]	[_____]	[_____]

-- End of Section --