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Preparing Activity: USACE Superseding
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated March 2008

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SECTION 23 11 25

FACILITY GAS PIPING

11/08

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SECTION 23 11 25

FACILITY GAS PIPING 11/08

NOTE: This guide specification covers the requirements for low pressure facility gas piping systems conforming to [NFPA 54/ANSI Z223.14] [NFPA 58] for non-industrial uses.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

This guide specification includes tailoring options for Natural Gas (NG) and Liquid Petroleum Gas (LPG) facility piping systems. Selection or deselection of a tailoring option (select view-tailoring options) will include or exclude that option in the section. Specific project editing is still required for the resulting section.

PART 1 GENERAL

NOTE: This guide specification is intended for use when specifying the following facility gas distribution systems:

low pressure natural gas systems, 34 kPa (5 psi) maximum, except for gas-air mixtures within the flammable range are limited to 69 kPa (10 psi) maximum,

low pressure undiluted LPG systems, 140 kPa (20psi) maximum,

aboveground steel piping both outside (up to 1.50 meters (5 feet) beyond exterior walls) and within buildings in compliance with [NFPA 54/ANSI Z223.14] [NFPA 58], "Fuel Gas Piping",

thermoplastic gas pressure pipe, tubing, and fittings,

aluminum and aluminum-alloy drawn seamless tubes,

reinforced epoxy resin gas pressure pipe and fittings,

for non-industrial uses.

Use Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION for external utility (beyond 1.50 meters (5 feet) from exterior walls) [natural gas distribution] [liquid petroleum gas (LPG)] (includes tailoring for LPG systems).

Use Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION contains tailoring for utility metering systems. (The Energy Independence and Security Act (EISA 2007) requires equivalent metering of natural gas and steam in accordance with the guidelines established under the act prior to October 1, 2016.)

As a minimum, show the following information 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. Meter location and emergency shut-offs.
6. Location and capacity of LP gas containers.

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 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 B109.1 (2000) Diaphragm-Type Gas Displacement Meters (Under 500 cubic ft./hour Capacity)
- AGA B109.3 (2000) Rotary-Type Gas Displacement Meters
- AGA XR0603 (2006) AGA Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

AMERICAN PETROLEUM INSTITUTE (API)

- API 570 (1998; Addendum 1 2000, Addendum 2 2001, Addendum 3 2003, Addendum 4 2006) Piping Inspection Code
- API MPMS 2.2A (1995; R 2007) Manual of Petroleum Measurement Standard Chapter 2 - Tank Calibration Section 2A - Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method
- API MPMS 2.2E (2004) Petroleum and Liquid Petroleum Products - Calibration of Horizontal Cylindrical Tanks - Part 1: Manual Methods
- API RP 1110 (2007) Pressure Testing of Liquid Petroleum Pipelines
- API RP 2003 (2008) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents

API RP 2009	(2002) Safe Welding, Cutting, and Hot Work Practices in the Petroleum and Petrochemical Industries
API Spec 15LR	(2001) Specification for Low Pressure Fiberglass Line Pipe and Fittings
API Spec 5CT	(2005; Errata 2006; Errata 2006) Specification for Casing and Tubing
API Spec 6D	(2008; Errata 2008; Errata 2008) Specification for Pipeline Valves
API Std 598	(2004) Valve Inspecting and Testing
API Std 607	(2005; Errata 2008) Fire Test for Soft-Seated Quarter-Turn Valves
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 25	(2008) Standard for Earthquake-Activated Automatic Gas Shutoff Devices
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.8/A5.8M	(2004; Errata 2004) Specification for Filler Metals for Brazing and Braze Welding
AWS WHB-2.9	(2004) Welding Handbook; Volume Two - Welding Processes
ASME INTERNATIONAL (ASME)	
ASME A13.1	(2007) Scheme for the Identification of Piping Systems
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.11	(2005) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2005) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2006) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.33	(2002; R 2007) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psi, Sizes NPS 1/2 - NPS 2
ASME B16.39	(1998; R 2006) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.5	(2003) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.9	(2008) Building Services Piping
ASME B36.10M	(2004) Standard for Welded and Seamless Wrought Steel Pipe
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2007; Addenda 2008) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2007; Addenda 2008) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM 01.01	(2009) Steel - Piping, Tubing, Fittings
ASTM A 105/A 105M	(2005) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A 181/A 181M	(2006) Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
ASTM A 513	(2008a) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM A 53/A 53M	(2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 666	(2003) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM B 210	(2004) Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 210M	(2005) Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)
ASTM B 241/B 241M	(2002) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 280	(2008) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D 2513	(2008b) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(2006) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM F 2015	(2000) Standard Specification for Lap Joint Flange Pipe End Applications

CANADIAN STANDARDS ASSOCIATION (CSA)

CSA 3.11-CAN/CGA	(1988; R 2003) Lever Operated Pressure Lubricated Plug Type Gas Shut-Off Valves
CSA CGA 3.16-M88	(1988; R 2003) Lever Operated Non-Lubricated Gas Shut-Off Valves
CSA CGA 9.2	(1988; R 2003) Manually Operated Shut-Off Valves for Gas Piping Systems - First Edition; General Instruction No 1

CSA AMERICA, INC. (CSA/AM)

CSA/AM ANSI Z21.1	(2005; Addenda A 2007; Addenda B 2008) Household Cooking Gas Appliances
CSA/AM Z21.15	(1997; R 2003; A 2006) Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
CSA/AM Z21.18	(2007) Gas Appliance Pressure Regulators
CSA/AM Z21.21	(2005) Automatic Valves for Gas Appliances
CSA/AM Z21.24	(2006) Connectors for Gas Appliances
CSA/AM Z21.41	(2003; A 2005; Errata 2007) Quick-Disconnect Devices for Use with Gas Fuel Appliances
CSA/AM Z21.69	(2002; Addenda A 2003; Addenda B 2006; R 2007) Connectors for Movable Gas Appliances
CSA/AM Z21.78	(2005; Addenda A 2007; Addenda B 2008) Standard Specification for Combination Gas Controls for Gas Appliances
CSA/AM Z21.80	(2005; Addenda 2005; R 2008) Line Pressure Regulators

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

MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
MSS SP-83	(2006) Standard for Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-86	(2002) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2008) National Fuel Gas Code
NFPA 58	(2007; Amendment 1 2007; Amendment 2 2007; Amendment 3 2007; Amendment 4 2008) Liquefied Petroleum Gas Code
NFPA 70	(2007; AMD 1 2008) National Electrical Code - 2008 Edition

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

SMACNA 1650	(1998; Addendum 2000) Seismic Restraint Manual Guidelines for Mechanical Systems - Second Edition
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6	(7) Commercial Blast Cleaning
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UNDERWRITERS LABORATORIES (UL)

UL 125	(2007) Standard for Valves for Anhydrous Ammonia and LP-Gas (Other than Safety Relief)
UL 842	(2007) Standard for Valves for Flammable Fluids
UL 860	(2001) Standard for Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service
UL Gas&Oil Dir	(2008) Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SYSTEM DESCRIPTION

The gas piping system includes natural gas liquid petroleum piping and appurtenances from point of connection with supply system, as indicated, to gas operated equipment within the facility. Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, in three separate packages. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section, with additions and modifications specified herein. [Provide cathodically protected insulating joints connecting aboveground piping from the meter to the building, with [lightning arrestors] [zinc grounding cells] conforming to API RP 2003, installed where indicated.]

1.2.1 Gas Facility System and Equipment Operation

Include shop drawings showing piping layout, locations of system valves, gas line markers[and cathodic protection system]; step-by-step procedures for system start up, operation and shutdown (index system components and equipment to the system drawings); isolation procedures including valve operation to shutdown or isolate each section of the system (index valves to the system maps and provide separate procedures for normal operation and emergency shutdown if required to be different). Submit Data package No. 4.

1.2.2 Gas Facility System Maintenance

Include maintenance procedures and frequency for system and equipment; identification of pipe materials and manufacturer by locations, pipe repair procedures, and jointing procedures at transitions to other piping material or material from a different manufacturer. Submit Data Package No.4.

1.2.3 Gas Facility Equipment Maintenance

Include identification of valves, shut-offs, disconnects, and other equipment by materials, manufacturer, vendor identification and location; maintenance procedures and recommended tool kits for valves and equipment; recommended repair methods (i.e., field repair, factory repair, or replacement) for each valve and piece of equipment; and preventive maintenance procedures, possible failure modes and troubleshooting guide. Submit Data Package No. 3.

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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.

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.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gas Piping System[; G][; G, [_____]]

SD-03 Product Data

[Pipe and Fittings[; G][; G, [_____]]
 Gas equipment connectors[; G][; G, [_____]]
 LPG containers and accessories[; G][; G, [_____]]
 Gas Piping System[; G][; G, [_____]]
 Pipe Coating Materials and application procedures[; G][; G, [_____]]
]
 Pressure regulators[; G][; G, [_____]]
 Risers[; G][; G, [_____]]
 Transition fittings[; G][; G, [_____]]
 Valves[; G][; G, [_____]]
 Valve box[; G][; G, [_____]]
 Warning and identification tape[; G][; G, [_____]]

SD-06 Test Reports

Testing[; G][; G, [_____]]
 Pressure Tests[; G][; G, [_____]]
 Pressure Tests for Liquefied Petroleum Gas[; G][; G, [_____]]
 Test With Gas[; G][; G, [_____]]

SD-07 Certificates

Welders procedures and qualifications[; G][; G, [_____]]
 assigned number, letter, or symbol[; G][; G, [_____]]

SD-08 Manufacturer's Instructions

PE pipe and fittings[; G][; G, [_____]]
 pipe coating materials and application procedures[; G][; G, [_____]]

]

SD-10 Operation and Maintenance Data

Gas facility system and equipment operation[; G][; G, [____]]
Gas facility system maintenance[; G][; G, [____]]
Gas facility equipment maintenance[; G][; G, [____]]

Data packages, as specified.

1.4 QUALITY ASSURANCE

Submit manufacturer's descriptive data and installation instructions for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Mark all valves, flanges and fittings in accordance with **MSS SP-25**.

1.4.1 Welding Qualifications

NOTE: When the need exists for more stringent welding requirements, the designer may develop an alternate paragraph from industry standards using the applicable portions of Section 43 02 00 WELDING PRESSURE PIPING as a guide.

a. Weld piping in accordance with qualified procedures using performance qualified welders and welding operators in accordance with **API RP 2009**, **ASME BPVC SEC IX**, and **ASME B31.9**. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by **ASME B31.9**. Notify the Contracting Officer at least 24 hours in advance of tests, and perform at the work site if practicable.

b. Submit a certified copy of **welders procedures and qualifications** metal and PE in conformance with **ASME B31.9** for each welder and welding operator. Submit the **assigned number, letter, or symbol** that will be used in identifying the work of each welder to the Contracting Officer.[Weld all structural members in accordance with Section **05 05 23 WELDING, STRUCTURAL**, and in conformance with **AWS A5.8/A5.8M**, and **AWS WHB-2.9**.]

1.4.2 Jointing Thermoplastic and Fiberglass Piping

Perform all jointing of piping using qualified joiners and qualified procedures in accordance with **AGA XR0603**. Furnish the Contracting Officer with a copy of qualified procedures and list of and identification symbols of qualified joiners. Submit manufacturer's installation instructions and manufacturer's visual joint appearance chart, including all **PE pipe and fittings**.

1.4.3 Shop Drawings

Submit drawings for complete **Gas Piping System**, within [30] [____] days of contract award, showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of **gas equipment connectors** and supports. **Include LP storage tank, pad, and mounting details**.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store plastic pipe and fittings carefully. Plug or cap [pipe and fittings](#) ends during transportation or storage to minimize dirt and moisture entry. Do not subject piping to abrasion or concentrated external loads. Discard PE pipe sections and fittings that have been damaged.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos are not allowed. Submit catalog data and installation instructions for pipe, valves, all related system components, [pipe coating materials and application procedures](#). Conform to [NFPA 54 NFPA 58](#) and with requirements specified herein. Provide supply piping to appliances or equipment at least as large as the inlets thereof.

2.2 GAS PIPING SYSTEM AND FITTINGS

NOTE: When acceptable to the serving gas supplier aluminum, thermoplastic or fiberglass pipe; copper, aluminum alloy, or steel tubing may be used with gases not corrosive to such materials. Before selecting aluminum, copper, thermoplastic or fiberglass materials, contact the gas supplier for a gas analysis to determine the types of chemicals which will be in the gas supply, and select suitable materials based on the gas analysis. In general, odorized gas is not suitable for aluminum or copper bearing materials.

[2.2.1 Steel Pipe, Joints, and Fittings

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 carbon steel in accordance with [ASTM A 53/A 53M](#), 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: MSS SP-83 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, with flange faces having integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

NOTE: Other materials, such as threaded ductile iron, copper or brass pipe in iron pipe sizes, may be used with gases noncorrosive to such materials. Designer may specify other approved materials and list proper reference publications based on those materials in this paragraph and reference paragraph. Designer also may delete materials or equipment listed if not desirable or applicable.

Provide steel pipe conforming to ASME B36.10M; and malleable-iron threaded fittings conforming to MSS SP-86 ASME B16.1 and ASME B16.3. Provide steel pipe flanges and flanged fittings, including bolts, nuts, and bolt pattern in accordance with ASME B16.5 and ASTM A 105/A 105M. Provide wrought steel butt welding fittings conforming to ASME B16.9. Provide socket welding and threaded forged steel fittings conforming to MSS SP-83 ASME B16.11[and ASTM A 181/A 181M, Class 60].

] [2.2.2 Aluminum Alloy Pipe and Tubing, Joints, and Fittings

Provide aluminum alloy pipe conforming to ASTM B 241/B 241M, except that alloy 5456 is not allowed. Mark the ends of each length of pipe indicating it conforms to NFPA 54 NFPA 58. Thread, flange, braze, or weld pipe joints. Provide aluminum alloy tubing conforming to ASTM B 210M ASTM B 210, Type A or B, or ASTM B 241/B 241M, Type A or equivalent, with joints made up with gas tubing fittings recommended by the tubing manufacturer.

] [2.2.3 Copper Tubing, Joints and Fittings

Provide copper tubing conforming to ASTM B 88M ASTM B 88, Type K or L, or ASTM B 280, with tubing joints made up with tubing fittings recommended by the tubing manufacturer. Provide copper and copper alloy press fittings, with sealing elements of Hydrogenated Nitrile Butadiene Rubber (HNBR), factory installed, or an alternative supplied by the fitting manufacturer.

] [2.2.4 Steel Tubing, Joints and Fittings

Provide steel tubing conforming to ASTM 01.01, and ASTM A 513, with tubing joints made up with gas tubing fittings recommended by the tubing manufacturer.

] [2.2.5 Thermoplastic Pipe, Tubing, Joints, and Fittings

NOTE: Use of thermoplastic pipe or components is not allowed under buildings. Use only for outdoor, underground installations only.

Provide thermoplastic pipe, tubing, casing and joints and fittings

conforming to ASTM D 2513 and API Spec 5CT.

]2.2.6 Fiberglass Pipe, Joints, and Fittings

Provide fiberglass piping systems conforming to ASTM D 2517 and API Spec 15LR.

]2.2.7 Sealants for Steel Pipe Threaded Joints

**NOTE: Use this paragraph only if steel threaded
pipe is specified.**

Provide joint sealing compound as listed in UL Gas&Oil Dir, Class 20 or less. For taping, use tetrafluoroethylene tape conforming to UL Gas&Oil Dir.

]2.2.8 Warning and Identification

Provide pipe flow markings, warning and identification tape, and metal tags as required.

2.2.9 Flange Gaskets

Provide gaskets of nonasbestos compressed material in accordance with ASME B16.21, 1.6 mm 1/16 inch thickness, full face or self-centering flat ring type, containing aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 316 degrees C 600 degree F service, to be used for hydrocarbon service.

2.2.10 Pipe Threads

Provide pipe threads conforming to ASME B1.20.1.

2.2.11 Escutcheons

Provide chromium-plated steel or chromium-plated brass escutcheons, either one piece or split pattern, held in place by internal spring tension or set screw.

2.2.12 Gas Transition Fittings

**NOTE: Choose the applicable options from the
following:**

[a. Provide steel to plastic (PE) designed for steel-to-plastic with tapping tee or sleeve conforming to AGA XR0603 requirements for transitions fittings.. 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 conforming to ASTM A 666, 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.]]

[c.[Provide lever operated pressure lubricated plug type gas shut-off valve conforming to CSA 3.11-CAN/CGA.][Provide lever operated non-lubricated gas shut-off valves conforming to CSA CGA 3.16-M88][Provide manually operated shut-off valve conforming to CSA CGA 9.2]]

2.2.13 Insulating Pipe Joints

2.2.13.1 Insulating Joint Material

Provide insulating joint material between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.2.13.2 Threaded Pipe Joints

Provide threaded pipe joints of steel body nut type dielectric unions with insulating gaskets.

2.2.13.3 Flanged Pipe Joints

Provide joints for flanged pipe consisting of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts. [Provide lap joint flange pipe ends conforming to ASTM F 2015.]

2.2.14 Flexible Connectors

a. Provide flexible connectors for connecting gas utilization equipment to building gas piping conforming to CSA/AM Z21.24, ANSI Z21.45, or CSA/AM Z21.41 for quick disconnect devices, and flexible connectors for movable food service equipment conforming to CSA/AM Z21.69.[Provide combination gas controls for gas appliances conforming to CSA/AM Z21.78.]

b. Do not install the flexible connector through the appliance cabinet face. Provide rigid metallic pipe and fittings to extend the final connection beyond the cabinet, except when appliance is provided with an external connection point.

2.3 VALVES

Provide [lockable]shutoff or service isolation valves [as indicated in the drawings]conforming to the following:

2.3.1 Valves 50 mm 2 Inches and Smaller

Provide valves 50 mm 2 inches and smaller conforming to ASME B16.33 of materials and manufacture compatible with system materials used.[Provide manually operated household cooking gas appliance valves conforming to CSA/AM ANSI Z21.1 and CSA/AM Z21.15.]

[2.3.2 Valves 65 mm 2-1/2 Inches and Larger

NOTE: Use the following for projects requiring
larger volumes and pipe sizes over 2-1/2 inches.

Provide valves 65 mm 2-1/2 inches and larger of carbon steel conforming to

API Spec 6D, Class 150.

] 2.4 RISERS

Provide 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 on the drawings].

2.5 PIPE HANGERS AND SUPPORTS

Provide pipe hangers and supports conforming to MSS SP-58 and MSS SP-69.

[2.6 [METERING,] REGULATORS AND SHUTOFF VALVES

NOTE: Interior and/or exterior metering, pressure regulating, and primary shutoff valves for gas fuel systems are specified in Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION. If that section is not a part of the contract specifications, applicable paragraphs should be specified in this specification.

[Provide [diaphragm-type meter conforming to AGA B109.1] [rotary-type displacement meter conforming to AGA B109.3] as required by local gas utility supplier, [including valve box] conforming to NFPA 54.] Provide pressure gauges and attachments conforming to ASME B40.100. Provide regulators conforming to [CSA/AM Z21.18 for appliances] [CSA/AM Z21.78 for combination gas controls for gas appliances] [, and CSA/AM Z21.80 for line pressure regulators]. Provide shutoff valves conforming to [CSA/AM Z21.15 for manually controlled gas shutoff valves] [and] [CSA/AM Z21.21 for automatic shutoff valves for gas appliances].

] 2.7 SEISMIC PROVISIONS

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

Provide earthquake automatic gas shutoff valve conforming to ASCE 25, SMACNA 1650, 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.

] 2.8 LIQUIFIED PETROLEUM GAS - (LPG), 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 4.5 cubic meters (1,200 gallons) water capacity or less.

Provide NFPA 58, [DOT] [or] [ASME] compliant 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, and [API MPMS 2.2A for upright cylindrical tanks] [API MPMS 2.2E for horizontal cylindrical tanks] Provide valves conforming to UL 125 and UL 842. Provide pipe unions conforming to UL 860.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy or areas of conflict before performing the work.

3.2 EXCAVATION AND BACKFILLING

Provide required excavation, backfilling, and compaction as specified in Section 31 00 00 EARTHWORK.

3.3 GAS PIPING SYSTEM

Provide a gas piping system from the point of delivery, defined as the outlet of the [meter set assembly] [service regulator] [shutoff valve], as specified in Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION, to the connections to each gas utilization device.

3.3.1 Protection and Cleaning of Materials and Components

Protect equipment, pipe, and tube openings by closing with caps or plugs during installation. At the completion of all work, thoroughly clean the entire system.

3.3.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Repair of defects in piping, tubing or fittings is not allowed; replace defective items when found.

3.4 PROTECTIVE COVERING

3.4.1 Underground Metallic Pipe

Protect buried metallic piping from corrosion with protective coatings as specified in Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION. When dissimilar metals are joined underground, use gastight insulating fittings.

3.4.2 Aboveground Metallic Piping Systems

NOTE: This paragraph applies to normal interior and exterior conditions from the meter or main shut-off. Where severe corrosion is expected, edit this paragraph to provide for protection against

corrosion.

3.4.2.1 Ferrous Surfaces

Touch up shop primed surfaces with ferrous metal primer. Solvent clean surfaces that have not been shop primed. Mechanically clean surfaces that contain loose rust, loose mill scale and other foreign substances [by power wire brushing] [or] [commercial sand blasted conforming to SSPC SP 6] and prime with [ferrous metal primer] [or] [vinyl type wash coat]. Finish primed surfaces with two coats of exterior [oil paint] [or] [vinyl paint].

3.4.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, do not paint nonferrous surfaces. Paint surfaces of aluminum alloy pipe and fittings to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. Solvent-clean the surfaces and treat with vinyl type wash coat. Apply a first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd copolymer enamel.

3.5 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."

If underground piping is subject to physical damage, specify deeper burial depths to protect piping.

Install the gas system in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54NFPA 58, AGA XR0603, and as indicated. Perform all pipe cutting without damage to the pipe, with an approved type of mechanical cutter, unless otherwise authorized. Use wheel cutters where practicable. On steel pipe 150 mm 6 inches and larger, an approved gas cutting and beveling machine may be used. Cut thermoplastic and fiberglass pipe in accordance with AGA XR0603.

3.5.1 Metallic Piping Installation

Bury underground piping a minimum of 450 mm 18 inches below grade. Make changes in direction of piping with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction is not

permitted. Branch connection may be made with either tees or forged branch outlet fittings. Provide branch outlet fittings which are forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Do not use aluminum alloy pipe in exterior locations or underground.

3.5.2 Metallic Tubing Installation

Install metallic tubing using gas tubing fittings approved by the tubing manufacturer. Make branch connections with tees. Prepare all tubing ends with tools designed for that purpose. Do not use aluminum alloy tubing in exterior locations or underground.

3.5.3 Thermoplastic and Fiberglass Piping, Tubing, and Fittings

Installation of thermoplastic and fiberglass piping, tubing, and fittings is permitted only outside and underground. Bury piping a minimum of 450 mm 18 inches below grade. Install the piping to avoid excessive stresses due to thermal contraction, and use only where indicated.

3.5.4 Connections Between Metallic and Plastic Piping

Connections between metallic and plastic piping are only allowed outside, underground, and with approved transition fittings.

3.5.5 Piping Buried Under Buildings

Run underground piping installed beneath buildings in a steel pipe casing protected from corrosion with protective coatings as specified in Section 23 11 25 FACILITY GAS PIPING. Extend casing at least 100 mm 4 inches outside the building, and provide the pipe with spacers and end bushings to seal at both ends to prevent the entrance of water and/or the escape of gas. Extend a vent line from the annular space above grade outside to a point where gas will not be a hazard, and terminate in a rain/insect-resistant fitting.

3.5.6 Concealed Piping in Buildings

Do not use combinations of fittings (unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints) to conceal piping within buildings.

3.5.6.1 Piping in Partitions

Locate concealed piping in hollow, rather than solid, partitions. Protect tubing passing through walls or partitions against physical damage both during and after construction, and provide appropriate safety markings and labels..

3.5.6.2 Piping in Floors

NOTE: When acceptable to the serving gas supplier,
gas piping may be embedded in portland cement
concrete floor slabs. If acceptable, delete
brackets.

Lay piping in solid floors [except where embedment in concrete is

indicated] in channels suitably covered to permit access to the piping with minimum damage to the building. [Surround piping embedded in concrete by a minimum of 40 mm 1-1/2 inches of concrete and do not allow physical contact with other metallic items such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quickset additives or cinder aggregate.]

3.5.7 Aboveground Piping

Run aboveground piping as straight as practicable along the alignment and elevation indicated, with a minimum of joints, and separately supported from other piping system and equipment. Install exposed horizontal piping no farther than 150 mm 6 inches from nearest parallel wall and at an elevation which prevents standing, sitting, or placement of objects on the piping.

3.5.8 Final Gas Connections

NOTE: Only allow flexible connectors where they will not be vulnerable to physical abuse or will not be accessible to unqualified personnel. Acceptable locations would include locked equipment rooms, equipment suspended at least 3 meters (10 feet) above floor, and remote buildings with limited accessibility by unqualified personnel. If flexible connectors are allowed, include bracketed sentence prohibiting connectors from passing through the equipment cabinet.

Unless otherwise specified, make final connections with rigid metallic pipe and fittings. [Make final connections to kitchen ranges using flexible connectors not less than 1.02 m 40 inch long[, to afford access to coupling] [and] [to permit movement of equipment for cleaning].] [Flexible connectors may be used for final connections to residential dryers.] [Flexible connectors may be used for final connections to gas utilization equipment.] [In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet.] Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.5.9 Seismic Requirements

NOTE: Provide seismic details and show on the drawings. Delete bracketed phrase if no seismic details are provided.

Support and brace piping and attached valves to resist seismic loads in conformance with ASCE 25 [and] [as specified in UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS, and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT] [as shown on the drawings].

3.6 PIPE JOINTS

Design and install pipe joints to effectively sustain the longitudinal

pull-out forces caused by contraction of the piping or superimposed loads.

3.6.1 Threaded Metallic Joints

Provide threaded joints in metallic pipe with tapered threads evenly cut and made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 40 mm 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 50 mm 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, ream pipe and remove all burrs. Caulking of threaded joints to stop or prevent leaks is not permitted.

3.6.2 Welded Metallic Joints

Conform beveling, alignment, heat treatment, and inspection of welds to NFPA 54. Remove weld defects and make repairs to the weld, or remove the weld joints entirely and reweld. After filler metal has been removed from its original package, protect and store so that its characteristics or welding properties are not affected adversely. Do not use electrodes that have been wetted or have lost any of their coating.

3.6.3 Thermoplastic and Fiberglass Joints

NOTE: Thermoplastic and fiberglass pipe should not be installed where temperature will be below minus 29 degrees C (20 degrees F) or above 38 degrees C (100 degrees F). Fiberglass pipe may be used at temperatures up to 66 degrees C (150 degrees F), providing the pipe is marked in accordance with ASTM D 2513.

- a. Thermoplastic and Fiberglass: Conform jointing procedures to AGA XR0603. Do not make joints with solvent cement or heat of fusion between different kinds of plastics.
- b. 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, in conformance with API 570, 100 percent of all joints and re-inspect all corrections. Arrange with the pipe manufacturer's representative in the presence of the Contracting Officer to make first time inspection.

3.6.4 Flared Metallic Tubing Joints

Make flared joints in metallic tubing with special tools recommended by the tubing manufacturer. Use flared joints only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Do not use metallic ball sleeve compression-type tubing fittings for tubing joints.

3.6.5 Solder or Brazed Joints

Make all joints in metallic tubing and fittings with materials and procedures recommended by the tubing supplier. Braze joints with material

having a melting point above 538 degrees C 1000 degrees F, containing no phosphorous.

3.6.6 Joining Thermoplastic or Fiberglass to Metallic Piping or Tubing

When compression type mechanical joints are used, provide gasket material in the fittings compatible with the plastic piping and with the gas in the system. Use an internal tubular rigid stiffener in conjunction with the fitting, flush with end of the pipe or tubing, extending at least to the outside end of the compression fitting when installed. Remove all rough or sharp edges from stiffener. Do not force fit stiffener in the plastic. Split tubular stiffeners are not allowed.

3.6.7 Press Connections

Make press connections in accordance with manufacturer's installation instructions using tools approved by the manufacturer. Fully insert the tubing into the fitting and then mark at the shoulder of the fitting. Check the fitting alignment against the mark on the tubing to assure the tubing is fully inserted before the joint is pressed.

3.7 PIPE SLEEVES

Provide pipes passing through concrete or masonry walls or concrete floors or roofs with pipe sleeves fitted into place at the time of construction. Do not install sleeves in structural members except where indicated or approved. Make all rectangular and square openings as detailed. Extend each sleeve through its respective wall, floor or roof, and cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Extend sleeves in mechanical room floors above grade at least 100 mm 4 inches above finish floor. Unless otherwise indicated, use sleeves large enough to provide a minimum clearance of 6.4 mm 1/4 inch all around the pipe. Provide steel pipe for sleeves in bearing walls, waterproofing membrane floors, and wet areas. Provide sleeves in nonbearing walls, floors, or ceilings of steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, seal the annular space between the pipe and sleeve with fire-stopping material and sealant that meet the requirement of Section 07 84 00 WIRETAPPING.

3.8 PIPES PENETRATING WATERPROOFING MEMBRANES

Install pipes penetrating waterproofing membranes as specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.9 FIRE SEAL

Fire seal all penetrations of fire rated partitions, walls and floors in accordance with Section 07 84 00 FIRESTOPPING.

3.10 ESCUTCHEONS

Provide escutcheons for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.11 SPECIAL REQUIREMENTS

Provide drips, grading of the lines, freeze protection, and branch outlet locations as shown and conforming to the requirements of NFPA 54NFPA 58.

3.12 BUILDING STRUCTURE

Do not weaken any building structure by the installation of any gas piping. Do not cut or notch beams, joists or columns. Attach piping supports to metal decking. Do not attach supports to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer.

3.13 PIPING SYSTEM SUPPORTS

Support gas piping systems in buildings with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Do not support any gas piping system by other piping. Conform spacing of supports in gas piping and tubing installations to the requirements of NFPA 54NFPA 58. Conform the selection and application of supports in gas piping and tubing installations to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, use a clip or clamp where each pipe crosses the base support member. Spacing of the base support members is not to exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. Rigidly connect the clips or clamps to the common base member. Provide a clearance of 3.2 mm 1/8 inch between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.14 ELECTRICAL BONDING AND GROUNDING

NOTE: Conventional flange joints allow sufficient
current flow to satisfy this requirement.

Provide a gas piping system within the building which is electrically continuous and bonded to a grounding electrode as required by NFPA 70.

3.15 SHUTOFF VALVE

Install the main gas shutoff valve controlling the gas piping system to be easily accessible for operation, as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

[3.16 CATHODIC PROTECTION

NOTE: Use this paragraph only for those projects
requiring underground, or partially buried gas
piping systems

Designs are required to have cathodic protection for
underground ferrous gas piping regardless of soil
condition. Other guidance is available in TM
5-811-7. Provide cathodic protection on additions
to existing systems and stations for testing.

Provide cathodic protection for underground ferrous gas piping as specified in [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)] [Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT].

] 3.17 TESTING

Submit test reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Test entire gas piping system to ensure that it is gastight prior to putting into service. Prior to testing, blow out the system, clean, and clear all foreign material. Test each joint with an approved gas detector, soap and water, or an equivalent nonflammable solution. Inspect and test each valve in conformance with API Std 598 and API Std 607. Complete testing before any work is covered, enclosed, or concealed, and perform with due regard for the safety of employees and the public during the test. Install bulkheads, anchorage and bracing suitably designed to resist test pressures if necessary, and as directed and or approved by the Contracting Officer. Do not use oxygen as a testing medium.

3.17.1 Pressure Tests

Submit test reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Before appliances are connected, test by filling the piping systems with air or an inert gas to withstand a minimum pressure of 21 kPa 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 as specified in NFPA 58 without showing any drop in pressure. Do not use Oxygen for test. Measure pressure with a mercury manometer, slope gauge, or an equivalent device calibrated to be read in increments of not greater than 1 kPa 0.1 pound. Isolate the source of pressure before the pressure tests are made.

3.17.2 Pressure Tests for Liquified Petroleum Gas

Pressure test system as described above. When appliances are connected to the piping system, use fuel gas for testing appliances to withstand a pressure of not less than 2.5 kPa nor more than 3.5 kPa 10.0 inches nor more than 14.0 inches water column (0.36 nor more than 0.51 pounds per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Measure pressure with a water manometer or an equivalent device calibrated to be read in increments of not greater than 20 Pa 0.1 inch water column. Isolate the source of pressure before the pressure tests are made.

3.17.3 Test With Gas

Before turning on gas under pressure into any piping, close all openings from which gas can escape. Immediately after turning on the gas, check the piping system for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. Conform all testing to the requirements of NFPA 54NFPA 58. If leakage is recorded, shut off the gas supply, repair the leak , and repeat the tests until all leaks have been stopped.

3.17.4 Purging

After testing is completed, and before connecting any appliances, fully purge all gas piping. **LPG piping tested using fuel gas with appliances connected does not require purging. Conform testing procedures to API RP 1110.** Do not purge piping into the combustion chamber of an appliance. Do not purge the open end of piping systems into confined spaces or areas where there are ignition sources unless the safety precautions recommended in **NFPA 54NFPA 58** are followed.

3.17.5 Labor, Materials and Equipment

Furnish all labor, materials and equipment necessary for conducting the testing and purging.

3.18 PIPE COLOR CODE MARKING

**NOTE: Coordinate color code marking with Section
09 90 00. Add color code marking for piping not
listed in Table I of Section 09 90 00 to the table.**

Provide color code marking of piping as specified in Section **09 90 00**
PAINTS AND COATINGS, conforming to **ASME A13.1**.

-- End of Section --