****

USACE / NAVFAC / AFCEC / NASA **UFGS-23 11 20 (May 2020)**

Preparing Activity: USACE **Superseding without Revision UFGS-23 11 25 (November 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

****

SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 11 20

FACILITY GAS PIPING

05/20

PART 1 GENERAL

1.1 SUMMARY
1.2 REFERENCES
1.3 SYSTEM DESCRIPTION
1.3.1 Gas Facility System and Equipment Operation
1.3.2 Gas Facility System Maintenance
1.3.3 Gas Facility Equipment Maintenance
1.4 SUBMITTALS
1.5 QUALITY ASSURANCE
1.5.1 Welding Qualifications
1.5.2 Jointing Thermoplastic and Fiberglass Piping
1.5.3 Shop Drawings
1.6 DELIVERY, STORAGE, AND HANDLING
1.6.1 Plastic Pipe
1.6.2 CSST Tubing

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT
2.2 GAS PIPING SYSTEM AND FITTINGS
2.2.1 Steel Pipe, Joints, and Fittings
2.2.2 Aluminum Alloy Pipe and Tubing, Joints, and Fittings
2.2.3 Copper Tubing, Joints and Fittings
2.2.4 Steel Tubing, Joints and Fittings
2.2.5 Thermoplastic Pipe, Tubing, Joints, and Fittings
2.2.6 Fiberglass Pipe, Joints, and Fittings
2.2.7 Corrugated Stainless Steel Tubing, Fittings and Accessories
2.2.7.1 Tubing
2.2.7.2 Mechanical Fittings
2.2.7.3 Striker Plates
2.2.7.4 Manifolds
2.2.8 Sealants for Steel Pipe Threaded Joints
2.2.9 Warning and Identification
2.2.10 Flange Gaskets
2.2.11 Pipe Threads

2.2.12 Escutcheons
2.2.13 Gas Transition Fittings
2.2.14 Insulating Pipe Joints
2.2.14.1 Insulating Joint Material
2.2.14.2 Threaded Pipe Joints
2.2.14.3 Flanged Pipe Joints
2.2.15 Flexible Connectors
2.3 VALVES
2.3.1 Valves 50 mm 2 Inches and Smaller
2.3.2 Valves 65 mm 2-1/2 Inches and Larger
2.3.3 Valve Support on PE Piping
2.4 RISERS
2.5 PIPE HANGERS AND SUPPORTS
2.6 LINE AND APPLIANCE REGULATORS AND SHUTOFF VALVES
2.7 NATURAL GAS SERVICE
2.7.1 Service Regulators
2.7.2 Gas Meter
2.7.2.1 Utility Monitoring and Control System (UMCS) / Energy Monitoring and Control (EMCS) or Automatic Meter Reading Interfaces
2.7.2.2 Measurement Configuration
2.8 SEISMIC PROVISIONS
2.9 AUTOMATIC GAS SHUT-OFF
2.10 LIQUIFIED PETROLEUM GAS - (LPG), LPG CONTAINERS AND ACCESSORIES
2.11 BOLTING (BOLTS AND NUTS)
2.12 GASKETS
2.13 IDENTIFICATION FOR ABOVEGROUND PIPING

PART 3 EXECUTION

3.1 EXAMINATION
3.2 EXCAVATION AND BACKFILLING
3.3 GAS PIPING SYSTEM
3.3.1 Protection and Cleaning of Materials and Components
3.3.2 Workmanship and Defects
3.4 PROTECTIVE COVERING
3.4.1 Underground Metallic Pipe
3.4.2 Aboveground Metallic Piping Systems
3.4.2.1 Ferrous Surfaces
3.4.2.2 Nonferrous Surfaces
3.5 INSTALLATION
3.5.1 Metallic Piping Installation
3.5.2 Metallic Tubing Installation
3.5.3 Thermoplastic and Fiberglass Piping, Tubing, and Fittings
3.5.4 Connections Between Metallic and Plastic Piping
3.5.5 Piping and Tubing Buried Under Buildings
3.5.6 Concealed Piping in Buildings
3.5.6.1 Piping and Tubing in Partitions
3.5.6.2 Piping in Floors
3.5.7 Aboveground Piping
3.5.8 Final Gas Connections
3.5.9 Seismic Requirements
3.6 PIPE JOINTS
3.6.1 Threaded Metallic Joints
3.6.2 Welded Metallic Joints
3.6.3 Thermoplastic and Fiberglass Joints
3.6.3.1 Thermoplastic and Fiberglass
3.6.3.2 PE Fusion Welding Inspection
3.6.4 Flared Metallic Tubing Joints
3.6.5 Solder or Brazed Joints

3.6.6 Joining Thermoplastic or Fiberglass to Metallic Piping or Tubing
3.6.7 Press Connections
3.7 PIPE SLEEVES
3.8 PIPES PENETRATING WATERPROOFING MEMBRANES
3.9 FIRE SEAL
3.10 ESCUTCHEONS
3.11 SPECIAL REQUIREMENTS
3.12 BUILDING STRUCTURE
3.13 PIPING SYSTEM SUPPORTS
3.14 ELECTRICAL BONDING AND GROUNDING
3.15 SHUTOFF VALVE
3.16 LINE AND APPLIANCE PRESSURE REGULATORS
3.17 GAS SERVICE INSTALLATION
3.17.1 Service Line
3.17.2 Service Regulator
3.17.3 Gas Meter
3.18 CATHODIC PROTECTION
3.19 TESTING
3.19.1 Pressure Tests
3.19.2 Pressure Tests for Liquified Petroleum Gas
3.19.3 Test With Gas
3.19.4 Purging
3.19.5 Labor, Materials and Equipment
3.20 PIPE COLOR CODE MARKING

-- End of Section Table of Contents --

****

USACE / NAVFAC / AFCEC / NASA	**UFGS-23 11 20 (May 2020)**

Preparing Activity: USACE	**Superseding without Revision UFGS-23 11 25 (November 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
****

SECTION 23 11 20

FACILITY GAS PIPING
05/20

****
NOTE: This guide specification covers the requirements for low pressure facility gas piping systems conforming to NFPA 54 NFPA 58 for non-industrial uses.

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).
****

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 Z223.1] ,

"National Fuel Gas Code" and [NFPA 58], "Liquefied Petroleum Gas Code",

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 / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES 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 / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES 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.)

Define the gas meter, service regulator, and service line pipe, fittings, and appurtenances in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES when that specification is included in the project. Otherwise, use the definition of these components in this specification.

The gas meter, service regulator, and service line pipe, fittings, and appurtenances must meet the requirements of 49 CFR 192.

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 SUMMARY

This specification section applies to gas piping installed within buildings incidental underground piping under building, above ground steel piping and corrugated stainless steel tubing (CSST) both outside (up to

1.50 meters 5 feet beyond exterior walls) and within buildings in compliance with NFPA 54/AGA Z223.1, "National Fuel Gas Code" NFPA 58, "Fuel Gas Piping".

1.2 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	(2019) Rotary-Type Gas Displacement Meters
AGA ANSI B109.4	(2016) Self-Operated Diaphragm-Type Natural Gas Service Regulators for Nominal Pipe Size 1¼ inches (32 mm) and Smaller with Outlet Pressures of 2 psig (13.8 kPa) and Less
AGA XR0603	(2006; 8th Ed) AGA Plastic Pipe Manual for Gas Service
AGA Z223.1	(2012) National Fuel Gas Code

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.1/CSA 1.1	(2018) Household Cooking Gas Appliances
ANSI Z21.15/CSA 9.1	(2009; Addenda A 2012, Addenda B 2013; R 2019) Manually Operated Gas Valves for

	Appliances, Appliance Connector Valves and Hose End Valves
ANSI Z21.18/CSA 6.3	(2007; R 2017) Gas Appliance Pressure Regulators
ANSI Z21.21/CSA 6.5	(2015) Automatic Valves for Gas Appliances
ANSI Z21.24/CSA 6.10	(2015; R 2020) Connectors for Gas Appliances
ANSI Z21.41/CSA 6.9	(2014; R 2019) Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.69/CSA 6.16	(2015; R 2020) Connectors for Movable Gas Appliances
ANSI Z21.78/CSA 6.20	(2010; R 2020) Standard Specification for Combination Gas Controls for Gas Appliances
ANSI Z21.80/CSA 6.22	(2019) Line Pressure Regulators
ANSI Z21.93/CSA 6.30	(2017) Excess Flow Valves for Natural Gas and Propane Gas with Pressures up to 5 psig

AMERICAN PETROLEUM INSTITUTE (API)

API 570	(2016; Addendum 1 2017; Addendum 2 2018; ERTA 1 2018) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API MPMS 2.2A	(1995; R 2017) Manual of Petroleum Measurement Standards Chapter 2-Tank Calibration Section 2A-Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method
API MPMS 2.2E	(2004; Errata 2009; R 2009) Petroleum and Liquid Petroleum Products - Calibration of Horizontal Cylindrical Tanks - Part 1: Manual Methods
API RP 1110	(2013; R 2018) Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 2009	(2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants
API Spec 5CT	(2018) Casing and Tubing

API Spec 6D	(June 2018, 4th Ed; Errata 1 July 2018; Errata 2 August 2018) Specification for Pipeline and Piping Valves
API Spec 15LR	(2001; R 2018) Specification for Low Pressure Fiberglass Line Pipe
API Std 598	(2009) Valve Inspecting and Testing
API Std 607	(2016) Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A13.1	(2020) Scheme for the Identification of Piping Systems
ASME B1.1	(2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.33	(2012; R 2017) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psi, (Sizes NPS 1/2 - NPS 2)
ASME B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
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	(2018; Supplement 2018) Gas Transmission and Distribution Piping Systems
ASME B31.9	(2017) Building Services Piping
ASME B36.10M	(2015; Errata 2016) Welded and Seamless Wrought Steel Pipe
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals for Brazing and Braze Welding
AWS WHB-2.9	(2004) Welding Handbook; Volume 2, Welding Processes, Part 1

ASTM INTERNATIONAL (ASTM)

ASTM 01.01	(2019) Steel - Piping, Tubing, Fittings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105/A105M	(2018) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A181/A181M	(2014; R 2020) Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2020a) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A513/A513M	(2020a) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM A666	(2015) Standard Specification for Annealed

	or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM B210/B210M	(2019a) Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B241/B241M	(2016) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B280	(2020) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM D2513	(2018a) Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
ASTM D2517	(2018) Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM F2015	(2000; R 2013) Standard Specification for Lap Joint Flange Pipe End Applications

CSA GROUP (CSA)

ANSI LC 1/CSA 6.26	(2019) Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
CGA 3.11-M88	(2015) Lever Operated Pressure Lubricated Plug Type Gas Shut-Off Valves
CGA 3.16-M88	(2015) Lever Operated Non-Lubricated Gas Shut-Off Valves
CGA 9.2-M88	(1988; R 2009) Manually Operated Shut-Off Valves for Gas Piping Systems

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

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

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture,

	Selection, Application, and Installation
MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-86	(2014) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2021) National Fuel Gas Code
NFPA 58	(2020; TIA 20-1; TIA 20-2; TIA 20-3) Liquefied Petroleum Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

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

SMACNA 1981	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders
UFC 3-301-01	(2019) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

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

UNDERWRITERS LABORATORIES (UL)

UL 125	(2020) UL Standard for Safety Flow Control Valves for Anhydrous Ammonia and LP-Gas
UL 842	(2015; Reprint Oct 2017) UL Standard for Safety Valves for Flammable Fluids
UL 860	(2014) Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service
UL FLAMMABLE & COMBUSTIBLE	(2012) Flammable and Combustible Liquids and Gases Equipment Directory

1.3 SYSTEM DESCRIPTION

The gas piping system includes [natural gas] [and] [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.]

1.3.1 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.

1.3.2 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.

1.3.3 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.

1.4 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets

following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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[, [_____]]

SD-03 Product Data

Pipe and Fittings; G[, [_____]]

Gas Equipment Connectors; G[, [_____]]

LPG Containers and Accessories; G[, [_____]]

Gas Piping System; G[, [_____]]

Pipe Coating Materials; G[, [_____]]

Pressure Regulators; G[, [_____]]

Risers; G[, [_____]]

Transition Fittings; G[, [_____]]

Valves; G[, [_____]]

Warning and Identification Tape; G[, [_____]]

SD-06 Test Reports

Testing; G[, [_____]]

Pressure Tests; G[, [_____]]

Pressure Tests for Liquified Petroleum Gas; G[, [_____]]

Test with Gas; G[, [_____]]

SD-07 Certificates

Welders Procedures and Qualifications; G[, [_____]]

Assigned Number, Letter, or Symbol; G[, [_____]]

SD-08 Manufacturer's Instructions

PE Pipe and Fittings; G[, [_____]]

Pipe Coating Materials; G[, [_____]]

SD-10 Operation and Maintenance Data

Gas Facility System and Equipment Operation; G[, [_____]]

Gas Facility System Maintenance; G[, [_____]]

Gas Facility Equipment Maintenance; G[, [_____]]

1.5 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.

1.5.1 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 40 05 13.96 WELDING PROCESS 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 23.16 STRUCTURAL WELDING, and in conformance with AWS A5.8/A5.8M, and AWS WHB-2.9.]

1.5.2 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.

1.5.3 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.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Plastic Pipe

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.

1.6.2 CSST Tubing

Handle, transport and store CSST tubing on the wooden spool or shipping container provided by the manufacturer. Insure tubing ends are capped during transportation and storage to minimize dirt and moisture entry. Discard any tubing segment and fitting that has 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 54NFPA 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 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: MSS SP-83ASME 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 A105/A105M. Provide wrought steel buttwelding fittings conforming to ASME B16.9. Provide socket welding and threaded forged steel fittings conforming to MSS SP-83 ASME B16.11[and ASTM A181/A181M, Class 60].

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

Provide aluminum alloy pipe conforming to ASTM B241/B241M, 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 toASTM B210/B210M, Type A or B, or ASTM B241/B241M, 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 B88M ASTM B88, Type K or L, or ASTM B280, 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 A513/A513M, 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 D2513 and API Spec 5CT.

][2.2.6 Fiberglass Pipe, Joints, and Fittings

Provide fiberglass piping systems conforming to ASTM D2517 and API Spec 15LR.

][2.2.7 Corrugated Stainless Steel Tubing, Fittings and Accessories

Provide corrugated stainless steel tubing conforming to ANSI LC 1/CSA 6.26 (austenitic stainless steel of series 300) with tubing joints made with special mechanical fittings as supplied by the tubing manufacturer.

2.2.7.1 Tubing

Austenitic stainless alloy of series 300 with polyethylene jacket/coating in accordance with ANSI LC 1/CSA 6.26 for sizes 9.4-mm 3/8-inch through 50-mm 2-inch

2.2.7.2 Mechanical Fittings

Copper alloy with one end matched to the corrugated tubing and one end with NPT threads in accordance with ASME B1.20.1

2.2.7.3 Striker Plates

Hardened steel designed to protect tubing from mechanical damage in accordance with ANSI LC 1/CSA 6.26

2.2.7.4 Manifolds

Malleable iron, steel or copper alloy with threaded connections/ports in accordance with ASME B1.20.1

][2.2.8 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 FLAMMABLE & COMBUSTIBLE, Class 20 or less. For taping, use tetrafluoroethylene tape conforming to UL FLAMMABLE & COMBUSTIBLE.

]2.2.9 Warning and Identification

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

2.2.10 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.

2.2.11 Pipe Threads

Provide pipe threads conforming to ASME B1.20.2MASME B1.20.1.

2.2.12 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.

2.2.13 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 A666, 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 CGA 3.11-M88.][Provide lever operated non-lubricated gas shut-off valves conforming to CGA 3.16-M88][Provide manually operated shut-off valve conforming to CGA 9.2-M88]]

2.2.14 Insulating Pipe Joints

2.2.14.1 Insulating Joint Material

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

2.2.14.2 Threaded Pipe Joints

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

2.2.14.3 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 F2015.]

2.2.15 Flexible Connectors

a. Provide flexible connectors for connecting gas utilization equipment to building gas piping conforming to ANSI Z21.24/CSA 6.10 or ANSI Z21.41/CSA 6.9 for quick disconnect devices, and flexible connectors for movable food service equipment conforming to ANSI Z21.69/CSA 6.16.[Provide combination gas controls for gas appliances conforming to ANSI Z21.78/CSA 6.20.]

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 ANSI Z21.1/CSA 1.1 and ANSI Z21.15/CSA 9.1.]

[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 65 mm 2-1/2 inches.
****

Provide valves 65 mm 2-1/2 inches and larger of carbon steel conforming to API Spec 6D, Class 150.

][2.3.3 Valve Support on PE Piping

Provide valve support assembly in accordance with the PE piping maufacturer's requirements at valve terminations points.

]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].

2.5 PIPE HANGERS AND SUPPORTS

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

[2.6 LINE AND APPLIANCE REGULATORS AND SHUTOFF VALVES

****

NOTE: Regulators and shutoff valves specified herein are located downstream of the gas meter / service regulator, within the building gas supply system.

The customer's gas meter, service regulator, service line, and service line shutoff valve for gas fuel systems are specified in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES and must conform to 49 CFR 192 requirements. If that section is not a part of the contract specifications, select the applicable paragraphs included in this specification. Contact and validate with the installation's facility engineering the specific requirements for meters and regulators. Define on the drawings and in the specifications the requirements and division of responsibilities for providing both the meter and regulator.

****

Provide regulators conforming to [ANSI Z21.18/CSA 6.3 for appliances] [ANSI Z21.78/CSA 6.20 for combination gas controls for gas appliances] [, and ANSI Z21.80/CSA 6.22 for line pressure regulators]. Provide shutoff valves conforming to [ANSI Z21.15/CSA 9.1 for manually controlled gas shutoff valves] [and] [ANSI Z21.21/CSA 6.5 for automatic shutoff valves for gas appliances].

][2.7 NATURAL GAS SERVICE

****

NOTE: Paragraphs below specify the service regulator and gas meter that supply the building gas piping system. These components are specified in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES and must conform to 49 CFR 192 requirements.

If Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES is a part of the contract specifications, delete the paragraphs below.

If Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES is not a part of the contract specifications, include the paragraphs below.

Contact and validate with the installation's facility engineering the specific requirements for meters and regulators. Define on the drawings and in the specifications the requirements and division of responsibilities for providing both the meter and regulator.

****

2.7.1 Service Regulators

a. Provide ferrous bodied pressure regulators for individual service lines, capable of reducing distribution line pressure to pressures required for users. Provide service regulators conforming to AGA ANSI B109.4 CGA-6.18-M95 with full capacity internal relief [and overpressure shutoff]. Set pressure relief at a lower pressure than would cause unsafe operation of any connected user.

b. Adjust regulators for liquified petroleum gas to 2.5 to 3 kPa 10 to 12 inches of water column, with pressure relief set at 4 kPa 16 inches of water column.

c. Provide regulator(s) having a single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas flow rate at the regulator inlet pressure. Provide regulator valve vent of resilient materials designed to withstand flow conditions when pressed against the valve port, capable of regulating downstream pressure within limits of accuracy and limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Provide a self-contained service regulator, and pipe not exceeding exceed 50 mm 2 inch size.

2.7.2 Gas Meter

[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. [Provided with a strainer immediately upstream]. Provide [diaphragm-type meter conforming to AGA ANSI B109.1 for required flow rates less than 500 cfh, or AGA ANSI B109.2, for flow rates 500 cfh and above] [rotary-type displacement meter conforming to AGA ANSI B109.3] as required by local gas utility supplier. Provide combined [odometer-type] register totalizer index, UV-resistant index cover, water escape hole in housing, and means for sealing against tampering. Provide temperature-compensated type meters sized for the required volumetric flow rate and suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Provide meters with over-pressure protection as specified in 49 CFR 192 and ASME B31.8. Provide meters that are tamper-proof [with] [frost protection] [fungus protection][seismic protection]. Provide meters with a pulse switch initiator capable of operating up to speeds of 500 maximum pulses per minute with no false pulses and requiring no field adjustments. Provide not less than one pulse per 2.83 cubic meters 100 cubic feet of gas. Minimum service life must be 30,000,000 cycles.

2.7.2.1 Utility Monitoring and Control System (UMCS) / Energy Monitoring and Control (EMCS) or Automatic Meter Reading Interfaces

Provide gas meters capable of interfacing the output signal, equivalent to volumetric flow rate, with the existing UMCS / EMCS for data gathering in units of cubic meters cubic feet. Provide meters that do not require power to function and deliver data. Output signal must be either a voltage or amperage signal that can be converted to volumetric flow by using an appropriate scaling factor.

2.7.2.2 Measurement Configuration

For buildings that already have a gas meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a natural gas meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output to a data gathering device. If the existing gas meter will not accept a pulse kit or if no meter exists a new natural gas meter must be installed, also requiring a pulse output to a data gathering device. Ensure the pulse frequency and electronic characteristics are compatible with the existing data gathering device, if any.

][2.8 SEISMIC PROVISIONS

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

Provide earthquake automatic gas shutoff valve conforming to ASCE 25-16, SMACNA 1981 or excess flow valve (EFV) conforming with ANSI Z21.93/CSA 6.30 and UL listed or AGA listed or International Association of Plumbing and Mechanical Officials (IAPMO) listed. The earthquake valve may be either pendulum or ball construction with [remote [, pneumatic] [electronic] [or] [electric]] actuator. The EFV may be either a bypass (automatic reset) or a non-bypass type (manual reset).

]2.9 AUTOMATIC GAS SHUT-OFF

****
NOTE: This section has a corresponding graphic for attaching CSA US 3-92 called "IAS_3-92_Rev_020601.pdf"

NOTE: TO DOWNLOAD UFGS GRAPHICS

Go to http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/for
****

[Provide low pressure automatic gas shutoff or excess flow valve (EFV) downstream of the point of delivery after the [meter/regulator] [propane tank] conforming to ANSI Z21.93/CSA 6.30 and UL listed or CSA listed or International Association of Plumbing and Mechanical Officials (IAPMO) listed. The EFV may be either a bypass (automatic reset) or a non-bypass type (manual reset).][Provide low pressure automatic gas shutoff or excess flow valve (EFV) at each branch to an appliance.]

2.10 LIQUIFIED PETROLEUM GAS - (LPG), LPG CONTAINERS AND ACCESSORIES

****

NOTE: The maximum size permitted under DOT specifications is 0.50 cubic meter 1000 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 1200 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.

2.11 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 must 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 must extend through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Bolts must have American Standard regular square or heavy hexagon heads; nuts must be American Standard heavy semifinished hexagonal.

2.12 GASKETS

Fluorinated elastomer, compatible with flange faces.

2.13 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.

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 under "Gas Service" within this specification,][as specified in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES,] to the connections to each gas utilization device that is in compliance with NFPA 54[NFPA 58]..

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 must be clear and free of cutting burrs and defects in structure or threading and must 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 and tubing from corrosion by either: (1) applying protective coatings as specified in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES; (2) encasement in a water tight plastic conduit; or (3) encasement in a protective system designed and listed by the manufacturer for this application. 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/NACE No.3] 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[and] 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. CSST gas piping systems must be installed by contractors who have completed the manufacturer's training program as indicated on a certification card. 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. Maintain electrical continuity of gas piping system in accordance with NFPA 54 [NFPA 58], paragraph entitled 'Electrical Bonding and Grounding'.

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. Installations must be made using qualified procedures, by qualified installers, and in compliance with AGA XR0603 and NFPA 54 [NFPA 58], and must be inspected by a qualified inspector.

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 and Tubing Buried Under Buildings

Run underground piping and tubing installed beneath buildings in a steel pipe casing protected from corrosion with protective coatings as specified in Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES or installed within a water tight plastic conduit or as part of a listed encasement system. Extend casing or encasement system 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 and Tubing in Partitions

Locate concealed piping and tubing 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. Provide protection of concealed pipe and tubing in accordance with ANSI LC 1/CSA 6.26.

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 m 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 25-16[and][as specified in UFC 3-301-01, and Sections 13 48 73 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT and 23 05 48.19 [SEISMIC] BRACING FOR HVAC][as indicated]. CSST tubing and fittings that are seismically qualified in accordance with the FM APP GUIDE: Flexible Piping Systems for Flammable Gases must meet the seismic requirements in accordance with the manufacturer's installation instructions.

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

3.6.3.1 Thermoplastic and Fiberglass

****

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 D2513.

****

Conform jointing procedures to AGA XR0603. Do not make joints with solvent cement or heat of fusion between different kinds of plastics.

3.6.3.2 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, 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 FIRESTOPPINGG.

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-58. 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 that is electrically continuous and bonded to a grounding electrode as required by NFPA 54, NFPA 58, and 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. Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally.[Provide PE piping manufacturer bracket support assembly securely fastened to structure for valve connections to resist operating torque applied to PE pipes.] Provide stop valve on service branch at connection to main and shut-off valve on riser outside of building.

3.16 LINE AND APPLIANCE PRESSURE REGULATORS

Install line pressure regulators and appliance regulators in accordance with the manufacturer's requirements and in accordance with NFPA 54[NFPA 58]. Install each regulator in an accessible location and install shutoff valves ahead of each line and appliance regulator to allow for maintenance. Where vent limiting devices are not included in the regulators, install a vent pipe to the exterior of the building. Terminate all service regulator vents and relief vents in the outside air in rain and insect resistant fittings. Locate the open end of the vent

where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

3.17 GAS SERVICE INSTALLATION

[Gas service line, service regulator and gas company meter must be installed in accordance with Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES.] Installations must be in accordance with 49 CFR 192 and ASME B31.8. Contractor must submit and use only tested and approved work procedures. Contractor must use only welders and jointers who have been recently qualified by training and test for joining and installing the gas pipe material used on this job. The finished product must be inspected by a person qualified to inspect joints made by the particular procedures used to make joints.

****

NOTE: This section specifies service line, service regulator, and gas company meter. These components must be installed in accordance with 49 CFR 192 and ASME B31.8 to allow gas systems to be accepted by Utility Privatization Contractors.

These installations are also specified is Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES. If that section is not included in the contract documents, delete the reference statement above and include the paragraphs below in this specification.

Where project documentation includes Section 33 51 15 NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES, delete the paragraphs below and include the reference statement above.

****

[3.17.1 Service Line

Install service line, branch connection to the main, and riser in accordance with 49 CFR 192 and ASME B31.8. Provide a minimum of 485 mm 18 inches cover or encase the service line so that it is protected. Install service line so that no undue stress is applied to the pipe, connection, or riser. Install approved riser and terminate with an approved isolation valve, EFV and automatic shutoff device. After laying of pipe and testing, backfill the trench in accordance with Section 31 00 00 EARTHWORK.

Were steel pipe is used as service line, install corrosion prevention coating and cathodic protect for the steel service line. Where connected to an existing cathodically protected steel pipe, ensure electrical continuity from the riser to the branch connection to the main. Install a dielectric fitting on the riser to prevent electrical continuity to the above ground piping.

Where plastic pipe is used as the service line, make joints in accordance with procedures qualified by test. Personnel joining plastic pipe must be qualified by making a satisfactory specimen joint that passes the required inspection and test listed in 49 CFR 192.285. Inspection must be made by inspectors qualified in evaluating joints made under the specific joining procedure, as required by 49 CFR 192.287.

3.17.2 Service Regulator

Install service regulator in accordance with 49 CFR 192 and ASME B31.8 and this specification ensuring that the customer's piping is protected from over pressurization should the service regulator fail. A 3/8 inch tapped fitting equipped with a plug must be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. For inside installations, route the regulator vent pipe through the exterior wall to the atmosphere, and seal building penetrations for service line and vent. Terminate the regulator vent so that it is protected from precipitation and insect intrusion, so that it is not submerged during floods, and so that gas escaping will not create a hazard or enter the building through openings.

3.17.3 Gas Meter

Install shutoff valve, meter set assembly, and service regulator on the service line [outside the building] [inside the building, a minimum of 1 meter 3 feet from any potential ignition source], 18 inches above the [ground] [finished floor] on the riser. An insulating joint (dielectric connection) must be installed on the inlet side of the meter set assembly and service regulator and must be constructed to prevent flow of electrical current.

][3.18 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].

]3.19 TESTING

Submit test procedures and 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, purge 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.

3.19.1 Pressure Tests

Submit test procedures and 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 54as 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.

3.19.2 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.

3.19.3 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.

3.19.4 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.

3.19.5 Labor, Materials and Equipment

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

3.20 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 --