
USACE / NAVFAC / AFCEC / NASA UFGS-33 51 15 (February 2016)
Change 1 - 08/17

Preparing Activity: USACE

Superseding
UFGS-33 51 15 (November 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2017

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 51 15

NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION

02/16

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
 - 1.4.1 Qualifications
 - 1.4.1.1 Welding General
 - 1.4.1.2 Jointing of Polyethylene Piping
 - 1.4.2 Pre-Installation Conference
 - 1.4.2.1 Shop Drawings
 - 1.4.2.2 Connecting and Abandonment Plan
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - 1.5.1 Delivery and Storage
 - 1.5.2 Handling
 - 1.5.3 Corrugated Stainless Steel Tubing (CSST)
- 1.6 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS
 - 2.1.1 Steel Pipe
 - 2.1.2 Small Fittings
 - 2.1.3 Fittings, 50 mm 2 inches and Larger
 - 2.1.4 Steel Forged Branch Connections
 - 2.1.5 Flange Gaskets
 - 2.1.6 Pipe Threads
 - 2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints
 - 2.1.8 Corrugated Stainless Steel Tubing (CSST) Aboveground to Buildings and Vaults
 - 2.1.8.1 Tubing
 - 2.1.8.2 Mechanical Fittings
 - 2.1.8.3 Striker Plates
 - 2.1.8.4 Manifolds
 - 2.1.9 Sealants for Steel Pipe Threaded Joints

- 2.1.9.1 Sealing Compound
- 2.1.9.2 Tape
- 2.1.10 Identification
- 2.1.11 Insulating Joint Materials
 - 2.1.11.1 Threaded Joints
 - 2.1.11.2 Flanged Joints
 - 2.1.11.3 Dielectric Waterways and Flanges
- 2.1.12 Gas Transition Fittings
- 2.2 VALVES
 - 2.2.1 Steel Valves
 - 2.2.2 Steel Valve Operators
 - 2.2.3 Polyethylene Valves
 - 2.2.4 Excess Flow Valve (EFV)
- 2.3 PRESSURE REGULATORS
 - 2.3.1 Gas Main Regulators
 - 2.3.2 Service Regulators
- 2.4 METERS
 - 2.4.1 Utility Monitoring and Control System (UMCS) / Energy Monitoring and Control (EMCS) or Automatic Meter Reading Interfaces
 - 2.4.2 Measurement Configuration
- 2.5 EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF SYSTEM
- 2.6 EMERGENCY GAS SUPPLY CONNECTION
- 2.7 PROTECTIVE COVERING MATERIALS
- 2.8 TELEMETERING OR RECORDING GAUGES

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 EXCAVATION AND BACKFILLING
- 3.3 GAS MAINS
- 3.4 SERVICE LINES AND EMERGENCY GAS SUPPLY CONNECTION
 - 3.4.1 General
 - 3.4.2 Emergency Gas Supply Connection
- 3.5 WORKMANSHIP AND DEFECTS
- 3.6 PROTECTIVE COVERING
 - 3.6.1 Protective Covering for Underground Steel Pipe
 - 3.6.1.1 Thermoplastic Resin Coating System
 - 3.6.1.2 Inspection of Pipe Coatings
 - 3.6.2 Protective Covering for Aboveground Piping Systems
 - 3.6.2.1 Ferrous Surfaces
 - 3.6.2.2 Nonferrous Surfaces
 - 3.6.3 Protective Covering for Piping in Valve Boxes and Manholes
- 3.7 INSTALLATION
 - 3.7.1 Installing Pipe Underground
 - 3.7.2 Installing Pipe Aboveground
 - 3.7.2.1 Corrugated Stainless Steel Tubing (CSST)
 - 3.7.2.1.1 Mechanical Joints
 - 3.7.2.1.2 Tubing Size Changes
 - 3.7.2.1.3 Identification of Tubing
- 3.8 PIPE JOINTS
 - 3.8.1 Threaded Steel Joints
 - 3.8.2 Welded Steel Joints
 - 3.8.3 Polyethylene Pipe Jointing Procedures
 - 3.8.4 Connections Between Metallic and Plastic Piping
- 3.9 VALVE BOXES
- 3.10 DRIPS
- 3.11 PRESSURE REGULATOR INSTALLATION
 - 3.11.1 Main Distribution Line Regulators
 - 3.11.2 Service Line Regulators

- 3.12 METER INSTALLATION
- 3.13 CONNECTIONS TO EXISTING LINES
 - 3.13.1 Connections to Publicly or Privately Operated Gas Utility Lines
 - 3.13.2 Connection to Government Owned/Operated Gas Lines
- 3.14 CATHODIC PROTECTION
- 3.15 TESTS
 - 3.15.1 Destructive Tests of Plastic Pipe Joints
 - 3.15.2 Pressure and Leak Tests
 - 3.15.3 Meter Test
- 3.16 MAINTENANCE
 - 3.16.1 Gas Distribution System and Equipment Operation
 - 3.16.2 Gas Distribution System Maintenance
 - 3.16.3 Gas Distribution Equipment Maintenance

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEC / NASA UFGS-33 51 15 (February 2016)
Change 1 - 08/17

Preparing Activity: USACE Superseding
 UFGS-33 51 15 (November 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2017

SECTION 33 51 15

NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION
02/16

NOTE: This guide specification covers the requirements for natural or manufactured gas distribution systems designed in accordance with ASME B31.8, or Liquefied Petroleum Gas (LPG) Distribution systems designed in accordance with NFPA 58.

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 may be used for specifying liquefied petroleum gas (LPG) if the following modifications are made:

a. Delete all references to fiberglass and add the following to paragraph "Polyethylene Pipe, Tubing, Fittings and Joints" in PART 2: Polyethylene pipe, tubing, and fittings are recommended by the manufacturer for use with LPG.

b. Require, where applicable, the LPG distribution

system to be in accordance with NFPA 58, Storage and Handling of Liquefied Petroleum Gases, instead of ASME B31.8.

1.1 SUMMARY

The gas distribution system includes natural gas piping and appurtenances from point of connection with existing system, to a point approximately [1500] [_____] mm [5] [_____] feet from the [facility] [facilities]. Section 31 10 00 CLEARING FOR CIVIL WORKS, applies to this section unless otherwise specified.

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	(2000) Rotary-Type Gas Displacement Meters
AGA ANSI B109.4	(2016) Self-Operated Diaphragm-Type Natural Gas Service Regulators for Nominal Pipe Size 1½ 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

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L	(2012; ERTA 2015) Specification for Line Pipe
API Spec 6D	(2014; Errata 1-2 2014; Errata 3-6 2015; ADD 1 2015; ADD 2 2016; Errata 7-8 2016; Errata 9 2017) Specification for Pipeline and Piping Valves
API Std 1104	(2013; Errata 1-3 2014; Addendum 1 2014; Errata 4 2015; Addendum 2 2016) Welding of Pipeline and Related Facilities

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C213	(2015) Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(2013) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.40	(2013) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B31.8	(2014; Supplement 2014) Gas Transmission and Distribution Piping Systems
ASME BPVC SEC VIII D1	(2015) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME PTC 25	(2014) Pressure Relief Devices
ASTM INTERNATIONAL (ASTM)	
ASTM A181/A181M	(2014) Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
ASTM A333/A333M	(2016) Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM D2513	(2014; E 2014) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2683	(2014) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping
ASTM D3261	(2016) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3308	(2012) PTFE Resin Skived Tape
ASTM F1802	(2015) Standard Test Method for Performance Testing of Excess Flow Valves
ASTM F2138	(2012) Standard Specification for Excess Flow Valves for Natural Gas Service
ASTM F2786	(2010) Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Media Under Pressure (Pneumatic Leak Testing)
CSA GROUP (CSA)	
ANSI LC 1/CSA 6.26	(2016) Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
CSA/AM ANSI Z21.93/CSA 6.30	(2013) Excess Flow Valves for Natural and LP Gas with Pressures up To 5 psig

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

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2013) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends

MASTER PAINTERS INSTITUTE (MPI)

MPI 10	(Oct 2009) Exterior Latex, Flat, MPI Gloss Level 1
MPI 11	(Oct 2009) Exterior Latex, Semi-Gloss, MPI Gloss Level 5
MPI 119	(Oct 2009) Exterior Latex, Gloss
MPI 9	(Oct 2009) Exterior Alkyd, Gloss, MPI Gloss Level 6

NACE INTERNATIONAL (NACE)

NACE SP0185	(2007) Extruded Polyolefin Resin Coating Systems with Soft Adhesives for Underground or Submerged Pipe
NACE SP0274	(1974; R 2011) High Voltage Electrical Inspection of Pipeline Coatings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2015) National Fuel Gas Code
NFPA 58	(2017; ERTA 17-1) Liquefied Petroleum Gas Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007; E 2004) Brush-Off Blast Cleaning
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

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 FLAMMABLE & COMBUSTIBLE

(2012) Flammable and Combustible Liquids
and Gases Equipment Directory

1.3 SUBMITTALS

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

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

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

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

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

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

REPORTING. Submit the following in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pipe, Fittings, and Associated Materials

SD-03 Product Data

Materials and Equipment; G[, [_____]]

Spare Parts; G[, [_____]]

Pipe and Accessory Coatings; G[, [_____]]

SD-05 Design Data

Connections to Existing Lines; G[, [_____]]

Connection and Abandonment Plan; G[, [_____]]

SD-06 Test Reports

Pressure and Leak Tests

SD-07 Certificates

Welder's training, qualifications and procedures

Jointing of Polyethylene Piping

Utility Work

SD-08 Manufacturer's Instructions

EFV Design and Installation Guide

CSST Installation Guide

SD-10 Operation and Maintenance Data

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

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

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

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

1.4.1.1 Welding General

- a. Submit a certificate of Welder's training, qualifications and procedures, in conformance with API Std 1104, for metal along with a list of names and identification symbols of performance qualified welders and welding operators.
- b. Welding and nondestructive testing procedures for pressure piping are

specified in Section 40 05 13.96 WELDING PROCESS PIPING.

- c. Weld structural members in accordance with Section 05 05 23.16 STRUCTURAL WELDING.

1.4.1.2 Jointing of Polyethylene Piping

- a. Join piping by performance qualified PE joiners, qualified by a person who has been trained and certified by the manufacturer of the pipe, using manufacturer's pre-qualified joining procedures in accordance with AGA XR0603. Inspect joints by an inspector qualified in the joining procedures being used and in accordance with AGA XR0603. Welders training, qualifications and procedures, (metal and PE) includes use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA XR0603.
- b. Submit a certificate of qualified jointing procedures, training procedures, qualifications of trainer, and training test results for joiners and inspectors. Notify the Contracting Officer at least [24] [_____] hours in advance of the date to qualify joiners and inspectors.

1.4.2 Pre-Installation Conference

1.4.2.1 Shop Drawings

Submit shop drawings, within [30] [_____] days of contract award, containing complete schematic and piping diagrams and any other details required to demonstrate that the system has been coordinated and functions properly as a unit. Show on the drawings proposed layout and anchorage of the system and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.4.2.2 Connecting and Abandonment Plan

Submit written notification of the method and schedule for making connections to existing gas lines, to the Contracting Officer at least 10 days in advance. Include gas line tie in, hot taps, abandonment/removal or demolition, purging, and plugging as applicable in conformance with ASME B31.8 Include in submittal [connections to existing lines][connection and abandonment plan].

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to the site for damage, and store with a minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.2 Handling

Handle pipe and components carefully to ensure a sound, undamaged condition. Take particular care not to damage pipe coating. Repair damaged coatings to original finish. Do not place pipe or material of any kind inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Handle steel piping with coal-tar enamel coating in accordance with AWWA C203, and fusion-bonded

epoxy coatings per AWWA C213. Handle plastic pipe in conformance with AGA XR0603.

1.5.3 Corrugated Stainless Steel Tubing (CSST)

NOTE: Delete this paragraph if CSST is not used in the project.

Handle, transport and store CSST tubing on the wooden spool or shipping container provided by the manufacturer. Ensure tubing ends are capped during transportation and storage to minimize dirt and moisture entry. Discard any tubing segment and fitting that has been damaged.

1.6 EXTRA MATERIALS

Submit spare parts data for each different item of equipment and material specified, after approval of the detail shop drawings and not later than [_____] months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply.

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

Provide only materials that are allowed by 49 CFR 192 for the specified installation.

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. Provide written verification and point of contact for a supporting service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Mark all valves, flanges, and fittings in accordance with MSS SP-25. Submit a complete list of materials and equipment, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions, including, but not limited to the following:

- a. Dielectric Waterways and Flange Kits.
- b. Emergency Gas Supply Connection.
- c. Fittings
- d. Piping
- e. Pipe and Accessory coatings
- f. Pressure Reducing Valves.
- g. Meters
- h. Regulators.
- i. Shut-off Valves
- j. [_____] Earthquake Actuated Automatic Gas Shut-off System conforming to ASCE 25-16.
- k. Excess flow valve

2.1.1 Steel Pipe

NOTE: Delete all words in brackets when steel pipe

is expected to be subjected to unusually severe conditions (including handling) such as impact stresses, seismic forces, burial beneath vehicle or railroad crossings, significant differential settlement, or underneath piers.

API Spec 5L, Grade [A,] B, or X42, [ASTM A53/A53M, Grade A or B], [ASTM A333/A333M, Grade A or B], Schedule 40. Steel pipe and fittings installed below grade or in contact with the soil must be protected from corrosion by a suitable coating and cathodic protection system. Paint pipe and fittings installed aboveground. Provide butt weld wrought steel fittings, conforming to ASME B16.9, Schedule 40. Provide forged steel socket weld and threaded fittings, conforming to ASME B16.11. Verify that pipe wall thickness conforms to ASME B31.8 for larger sizes and high pressures.

2.1.2 Small Fittings

For sizes 40 mm 1-1/2 inches and smaller, provide fittings conforming to ASME B16.11.

2.1.3 Fittings, 50 mm 2 inches and Larger

Provide pipe flanges and flanged fittings, including bolts, nuts, and bolt patterns in accordance with ASME B16.5, Class [_____]. Provide butt weld fittings in accordance with ASME B16.9. Use weld neck flanges.

2.1.4 Steel Forged Branch Connections

Provide steel forged branch connections conforming to ASTM A181/A181M, Class 60, carbon steel.

2.1.5 Flange Gaskets

Provide non-asbestos compressed material gaskets in accordance with ASME B16.21, 1.6 mm 1/16 inch minimum thickness, full face or self-centering flat ring type, containing aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluoroethylene, suitable for maximum 315 degrees C 600 degrees F service and meeting applicable requirements of ASME B31.8. Gasket material must be compatible with the gas that is in the system and the known or expected contaminants that are in the gas.

2.1.6 Pipe Threads

Provide threaded pipe conforming to ASME B1.20.2/ASME B1.20.1.

2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints

NOTE: Before selecting polyethylene or fiberglass pipe material, contact the gas supplier for a gas analysis to determine the types of chemicals which will be in the gas to be supplied. Select suitable polyethylene or fiberglass pipe material based on the gas analysis.

Do not use polyethylene for gas lines with design

pressures above 690 kPa 100 psig or with operating temperatures below 7 degrees C 20 degrees F or above 60 degrees C 140 degrees F.

For thermoplastic (polyethylene) pipe in sizes from 15 mm through 150 mm 1/2 inch through 6 inches, select minimum wall thickness based on ASME B31.8, table 842.32(c); and select the standard dimension ratio (SDR) based on the long-term hydrostatic strength of S = 8.6 MPa 1,250 psi for PE 2406 or S = 11 MPa 1,600 psi for PE 3408 at 23 degrees C 73 degrees F for the following pressures:

Where the buried pipe system is expected to exceed 23 degrees C 73 degrees F at the design pressures stated above, use alternate materials.

Design Pressure at 23 degrees C 73 degrees F		
SDR	S = 8.62 MPa 1,250 psi	S = 11 MPa 1,600 psi
11	550 kPa80 psig	690 MPa100 psig
13.5	415 kPa60 psig	550 kPa80 psig
17	345 kPa50 psig	415 kPa60 psig
21	275 kPa40 psig	345 kPa50 psig
26	207 kPa30 psig	275 kPa40 psig

Provide polyethylene pipe, tubing, fittings and joints conforming to ASTM D2513, pipe designations PE 2406 and PE 3408, rated SDR [_____] or less, as specified in ASME B31.8. Mark pipe sections as required by ASTM D2513. Provide butt fittings conforming to ASTM D3261 and socket fittings conforming to ASTM D2683. Match fittings to the service rating of the pipe, with a minimum wall thickness of [_____]. [Use polyethylene pipe, tubing, and fittings as recommended by the manufacturer for use with LPG.] Perform underground installations in conformance with ASTM D2774.

Jointing of plastic pipe and fittings must be performed in accordance with 49 CFR 192 using qualified procedures that have passed all required testing identified in 49 CFR subpart 192.283, using qualified personnel that have been qualified under subpart 192.285. Joints must be inspected in accordance with 49 CFR 192 by personnel qualified under subpart 192.287.

2.1.8 Corrugated Stainless Steel Tubing (CSST) Aboveground to Buildings and Vaults

NOTE: If CSST is included in the design, ensure the installation notes in Part 3 of this specification are addressed.

2.1.8.1 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

2.1.8.2 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

2.1.8.3 Striker Plates

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

2.1.8.4 Manifolds

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

2.1.9 Sealants for Steel Pipe Threaded Joints

2.1.9.1 Sealing Compound

Provide joint sealing compound as listed in UL FLAMMABLE & COMBUSTIBLE, Class 20 or less.

2.1.9.2 Tape

Provide polytetrafluoroethylene tape conforming to ASTM D3308.

2.1.10 Identification

Provide pipe flow markings and metal tags for each valve, meter, and regulator as required by the Contracting Officer.

2.1.11 Insulating Joint Materials

Provide insulating joint materials between flanged or threaded metallic pipe systems to isolate galvanic or electrolytic action. Use insulating fittings to connect dissimilar metals and to connect unprotected piping to a gas main or service line that is catholically protected.

2.1.11.1 Threaded Joints

For threaded pipe joints, provide steel body nut type unions complying with ASME B16.39. Provide dielectric waterways with insulating gaskets.

2.1.11.2 Flanged Joints

For flanged pipe joints, provide full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

2.1.11.3 Dielectric Waterways and Flanges

Provide dielectric waterways with temperature and pressure rating equal to or greater than that specified for the connecting piping, with metal

connections on both ends suited to match connecting piping. Provide internally lined dielectric waterways, lined with an insulator specifically designed to prevent current flow between dissimilar metals, meeting the performance requirements described herein for dielectric waterways.

2.1.12 Gas Transition Fittings

Provide manufactured steel gas transition fittings approved for jointing steel and polyethylene pipe, conforming to AGA XR0603 requirements for transition fittings.

2.2 VALVES

NOTE: Valves and pressure regulators are necessary at all points where design requires pressure reduction or regulation. Require a shut-off valve upstream of the regulator. A central regulating station is generally provided by the gas company and is usually located near the entrance to the installation. When valves, gas pressure regulators, and related devices are required in the contract, ensure that all necessary equipment will comply with the requirements of the gas company, and revise these paragraphs as required. Provide a detail of each regulating station and the following data for each pressure regulator: materials of construction, flow rate, type and specific gravity of the gas, inlet and outlet pressures, accuracy of control, and size and type of connections.

Provide valves suitable for shutoff or isolation service and conforming to [MSS SP-110][, MSS SP-72] [, MSS SP-78]and the following:

2.2.1 Steel Valves

Provide steel valves 40 mm 1-1/2 inches and smaller installed underground conforming to ASME B16.34, carbon steel, socket weld ends, with square wrench operator adaptor. Provide steel valves 40 mm 1-1/2 inches and smaller installed aboveground conforming to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Provide steel valves 50 mm 2 inches and larger installed underground conforming to API Spec 6D, carbon steel, butt weld ends, Class [_____] with square wrench operator adaptor. Provide steel valves 50 mm 2 inches and larger installed aboveground conforming to API Spec 6D, carbon steel, butt weld or flanged ends, Class [_____] with handwheel or wrench operator.

2.2.2 Steel Valve Operators

Provide valves 200 mm 8 inches and larger with worm or spur gear operators, totally enclosed, grease packed, and sealed, with operators having Open and Closed stops and position indicators. Provide locking feature where indicated. Wherever the lubricant connections are not conveniently accessible, provide extensions for the application of lubricant. Provide valves with lubricant compatible with gas service.

2.2.3 Polyethylene Valves

Provide polyethylene valves conforming to ASME B16.40. Polyethylene valves, in sizes 15 mm to 150 mm 1/2 inch to 6 inches, may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.

2.2.4 Excess Flow Valve (EFV)

**NOTE: Coordinate valve requirements with 49 CFR
192.381 and 49 CFR 192.383.**

**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/NAVGRAPH/graphdoc.pdf>.

Provide either a bypass (automatic reset) or a non-bypass (manual reset) type EFV that conforms to ASTM F1802, ASTM F2138, and CSA/AM ANSI Z21.93/CSA 6.30. Provide EFV that is UL listed, CSA listed or International Association of Plumbing and Mechanical Officials (IAPMO) listed. Submit an EFV Design and Installation Guide which includes the manufacturer's product design data and installation instructions.

2.3 PRESSURE REGULATORS

**NOTE: Coordinate this paragraph with the specified
requirements in paragraph VALVES.**

Provide ferrous bodied regulators with backflow protection, designed to meet the pressure, temperature, flow and other service conditions.

2.3.1 Gas Main Regulators

Equip pressure regulators for main distribution lines, supplied from a source of gas which is at a higher pressure than the maximum allowable operating pressure for the system, with pressure regulating devices of adequate capacity. In addition to the pressure regulating devices, provide a protective method to prevent overpressuring of the system in accordance with 49 CFR 192 and ASME B31.8. Suitable protective devices are as follows:

- a. Spring-loaded relief valve meeting the provisions of ASME BPVC SEC VIII D1.
- b. Pilot-loaded back pressure regulator used as relief valve, so designed that failure of the pilot system causes the regulator to open.
- c. Weight-loaded relief valves conforming to ASME PTC 25.
- d. Monitoring regulator installed in series with the primary pressure regulator.

- e. Series regulator installed upstream from the primary regulator, set to limit the pressure on the inlet of the primary regulator continuously to the maximum allowable operating pressure of the system, or less.
- f. Automatic shutoff device installed in series with the primary regulator, set to shut off when the pressure on the distribution system reaches the maximum allowable operating pressure of the system, or less, which remains closed until manually reset.
- g. Spring-loaded, diaphragm type relief valves.

2.3.2 Service Regulators

NOTE: If service regulator does not have all the characteristics listed, or if gas contains materials which would interfere with operation of the regulator, install protective devices to prevent overpressuring of the user's system should the regulator fail. Install the following devices as an integral part of the regulator or as separate devices operating in conjunction with the regulator.

- a. Monitoring regulator
- b. Relief valve
- c. Automatic shutoff device

- 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 mm2 inch size.

2.4 METERS

NOTE: Provide gas meters for each service line to every building. Where meters have a maximum anticipated demand of less than 28 cubic meters/hour 1000 SCFH, require the meter to meet a design working pressure of 690 kPa 100 psi.

Delete mounting and special features that are not required. Retain strainer upstream of meter only if installed upstream of pressure regulator. Delete pulse switch and pulse requirements except for Air Force projects or when required by other users. Air Force Engineering Technical Letter Number 87-5 "Utility Meters in New and Renovated Facilities" provides guidance for when to exclude meters from Air Force new and major renovation projects. Review the requirements for gas meters in TI 800-01 Design Criteria and 10 CFR 435.

[AGA ANSI B109.1] [AGA ANSI B109.2] [AGA ANSI B109.3] [pipe] [pedestal] mounted, [diaphragm] or [bellows] [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.

2.4.1 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.

2.4.2 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.

2.5 EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF SYSTEM

NOTE: Include earthquake actuated automatic gas

shutoff system if the facility is either essential or hazardous. Determine the classification of the facility per UFC 3-310-04 and provide a detail on the drawings showing this system.

ASCE has developed a "Public-Approved Version" of ASCE 25-16 - Standard Specification for EARTHQUAKE ACTUATED AUTOMATIC GAS SHUTOFF DEVICES, dated 2008, which includes a test procedure to verify that the valve will activate during strong ground shaking but will not activate for minor ground shaking or accidental bumping by a pedestrian or vehicle.

The State of California, Division of the State Architect/Real Estate Services Division maintains a list of devices that have been tested and conform to the ASCE Standard; inquiries can be directed to telephone No. 916-445-2600.

Show the earthquake actuated automatic gas shutoff on the drawings when required in the project. The designer must fill the bracketed blank for additional local requirements, and ensure that a copy is included with the Contract documents.

Provide Earthquake Actuated Automatic Gas Shutoff devices conforming to ASCE 25-16 [UL or CSA listed][_____] [and] [requirements furnished by the Contracting Officer] [as listed by the State of [California] [_____] , Division of the State Architect as being tested and in conformance with specified requirements]. The valve may be either pendulum or ball construction with [remote [, pneumatic] [electronic] [or] [electric]] actuator.

2.6 EMERGENCY GAS SUPPLY CONNECTION

NOTE: Include emergency gas supply connections when the customer determines the ability to provide gas to the building is necessary during an outage of the gas distribution system. Show the emergency gas piping connection on the drawings when required in the project.

Provide an emergency gas supply connection consisting of piping (same size as service line) and accessories that enables a portable, commercial-sized gas cylinder system to be connected to the gas piping system. Cap this connection to prevent gas leakage with a lockable manual valve located to allow shutting off flow. Provide the entire assembly in a weatherproof, lockable box, with permanently installed written instructions stating the type and pressure of the gas allowed to be connected to the line, and providing specific instruction for testing of the integrity of the building's gas system with an inert gas before the fuel gas connection is made. Provide a subplate in the box that is required to be unbolted to gain access to the connection, and containing a warning regarding the potential consequences of using gas other than that specified or of failing to test system integrity before hooking up emergency fuel supply.

2.7 PROTECTIVE COVERING MATERIALS

Provide a continuously extruded polyethylene and adhesive coating system material conforming to NACE SP0185, Type A.

2.8 TELEMETERING OR RECORDING GAUGES

NOTE: On distribution systems supplied by a single district pressure regulating station, determine the necessity of installing telemetering or recording gauges in the supply line, taking into consideration the number of buildings supplied, the operating pressures, the capacity of installation, and other operating conditions.

Equip each distribution system supplied by more than one district pressure regulating station with telemetering or recording pressure gauges to indicate the gas pressure in the district line.

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 before performing the work.

3.2 EXCAVATION AND BACKFILLING

Earthwork is as specified in Section 31 00 00 EARTHWORK.

3.3 GAS MAINS

Provide [steel] [or] [polyethylene] pipe for gas mains. [Coat steel pipe and fittings with protective covering as specified.] [Do not install polyethylene mains aboveground.]

3.4 SERVICE LINES AND EMERGENCY GAS SUPPLY CONNECTION

3.4.1 General

NOTE: Locate service line isolation valve as close to the supply main as possible, but at a safe distance from traffic lanes.

Construct service lines of materials specified for gas mains and extend from a gas main to and including the point of delivery within 1.5 meters 5 feet of the building. The point of delivery is the [meter set assembly] [service regulator] [shutoff valve]. Connect the service lines to the gas mains [as indicated] [through service tees, with end of run plugged]. Where indicated, provide service line with an isolation valve of the same size as the service line. Make the service lines as short and as straight as practicable between the point of delivery and the gas main, without bends or lateral curves unless necessary to avoid obstructions or otherwise permitted. Lay service lines with as few joints as practicable using

standard lengths of pipe, use shorter lengths only for closures. Do not install polyethylene service lines aboveground [except as permitted in ASME B31.8].

3.4.2 Emergency Gas Supply Connection

NOTE: If it is expected that a portable gas tank providing pressure regulated gas would be provided during an emergency, locate the emergency gas connection downstream from the building's pressure regulator.

Provide an aboveground locked, valved and capped emergency gas supply connection [downstream] [upstream] of the pressure regulator, located outside of the building within 300 mm 12 inches of the exterior wall and installed in a weatherproof box which is mounted on the exterior wall and clearly marked with an appropriate metal sign mounted on wall above.

3.5 WORKMANSHIP AND DEFECTS

Ensure pipe, tubing, and fittings are clear and free of cutting burrs and defects in structure or threading, and thoroughly brushed and blown free of chips and scale. Do not repair, but replace defective pipe, tubing, or fittings.

3.6 PROTECTIVE COVERING

3.6.1 Protective Covering for Underground Steel Pipe

Except as otherwise specified, apply protective coverings mechanically in a factory or field plant especially equipped for the purpose. Hand apply protective covering to valves and fittings that cannot be coated and wrapped mechanically, preferably at the plant that applies the covering to the pipe. Coat and wrap joints by hand, in a manner and with materials that produce a covering equal in thickness to that of the covering applied mechanically.

3.6.1.1 Thermoplastic Resin Coating System

Provide a thermoplastic coating system conforming to NACE SP0185, Type A. Clean the exterior of the pipe to a commercial grade blast cleaning finish in accordance with SSPC SP 6/NACE No.3, and apply adhesive compound to the pipe. Immediately after the adhesive is applied, extrude a seamless tube of polyethylene over the adhesive to produce a bonded seamless coating, with a nominal thickness of 0.25 mm 10 mils (plus or minus 10 percent) of adhesive and 1.0 mm 40 mils (plus or minus 10 percent) of polyethylene for pipes up to 400 mm 16 inches in diameter. For pipes 450 mm 18 inches and larger in diameter, apply a minimum thickness to the pipe of 0.25 mm 10 mils (plus or minus 10 percent) adhesive and 1.5 mm 60 mils (plus or minus 10 percent) polyethylene. Apply joint coating and field repair material as recommended by the coating manufacturer, consisting of one the following:

- a. Heat shrinkable polyethylene sleeves.
- b. Polyvinyl chloride pressure-sensitive adhesive tape.
- c. High density polyethylene/bituminous rubber compound tape.

Inspect the coating system for holes, voids, cracks, and other damage during installation.

3.6.1.2 Inspection of Pipe Coatings

Repair any damage to the protective covering during transit and handling before installation. After field coating and wrapping has been applied, inspect the entire pipe using an electric holiday detector with impressed current set at a value in accordance with NACE SP0274 using a full-ring, spring-type coil electrode. Equip the holiday detector with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. Immediately repair all holidays in the protective covering upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Furnish labor, materials, and equipment necessary for conducting the inspection.

3.6.2 Protective Covering for Aboveground Piping Systems

Apply finish painting conforming to the applicable paragraphs of Section 09 90 00 PAINTS AND COATINGS and as follows:

3.6.2.1 Ferrous Surfaces

Touch up shop primed surfaces with ferrous metal primer of the same type paint as the shop primer. Solvent-clean surfaces that have not been shop primed in accordance with SSPC SP 1. Mechanically clean surfaces that contain loose rust, loose mill scale, and other foreign substances by power wire brushing in accordance with SSPC SP 3 or brush-off blast clean in accordance with SSPC 7/NACE No.4 and primed with ferrous metal primer in accordance with SSPC Paint 25. Finish primed surfaces with two coats of exterior alkyd paint conforming to MPI 9.

3.6.2.2 Nonferrous Surfaces

NOTE: Retain only the first sentence for normal conditions; delete the first sentence for corrosive conditions.

[Do not paint nonferrous surfaces.] [Paint nonferrous surfaces to corrosive conditions. Solvent-clean the surfaces in accordance with SSPC SP 1. Apply a first coat of MPI 10, and 2 coats of [MPI 119] [or] [MPI 11].]

3.6.3 Protective Covering for Piping in Valve Boxes and Manholes

Apply protective coating to piping in valve boxes or manholes as specified for underground steel pipe.

3.7 INSTALLATION

NOTE: When existing gas piping is abandoned, show disconnect details on the drawings. Refer to 49 CFR 192 and ASME B31.8 for guidance on preparing the disconnect details. 49 CFR 192 and ASME B31.8 requires physical disconnection from gas sources. Shutoff valves are not an acceptable means of

disconnect.

Install gas distribution system and equipment in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA XR0603 and 49 CFR 192. Perform abandonment of existing gas piping in accordance with ASME B31.8. Cut the pipe without damaging the pipe; unless otherwise authorized, use an approved type of mechanical cutter. Use wheel cutters where practicable. On steel pipe 150 mm6 inches and larger, an approved gas-cutting-and-beveling machine may be used. Cut plastic pipe in accordance with AGA XR0603. Design valve installation in plastic pipe to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box.[Install polyethylene mains and service lines for LPG only below ground in accordance with NFPA 58.] Install gas piping, appliances, and equipment in accordance with NFPA 54. [Install distribution piping in accordance with ASME B31.8.]

3.7.1 Installing Pipe Underground

NOTE: Indicate profile of gas lines on the drawing. If it is impractical to comply with the minimum cover specified for pipe, and necessary to prevent damage from external loads, the pipe will be installed in a casing. The locations of all casings and details of the installation will be indicated.

Grade gas mains and service lines as indicated. Weld joints in steel pipe except as otherwise permitted for installation of valves. Provide mains with 600 mm 24 inch minimum cover; service lines with 485 mm 18 inch minimum cover; and place both mains and service lines on firmly compacted select material for the full length. Where indicated, encase, bridge, or design the main to withstand any anticipated external loads as specified in ASME B31.8. Provide standard weight black steel pipe encasement material with a protective coating as specified. Separate the pipe from the casing by insulating spacers and seal the ends with casing bushings. Excavate the trench below pipe grade, bed with bank sand, and compact to provide full-length bearing. Laying pipe on blocks to produce uniform grade is not permitted. Ensure that the pipe is clean inside before it is lowered into the trench and keep free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, securely close open ends of pipe or fittings with expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Make changes in line or gradient that exceed the limitations specified with fittings. When cathodic protection is furnished, provide electrically insulated joints or flanges. When polyethylene piping is installed underground, place foil backed magnetic tape above the pipe in accordance with NFPA 54 to permit locating with a magnetic detector. After laying of pipe and testing, backfill the trench in accordance with Section 31 00 00 EARTHWORK.

3.7.2 Installing Pipe Aboveground

Protect aboveground piping against dirt and other foreign matter, as

specified for underground piping. Weld joints in steel pipe; however, joints in pipe 40 mm 1-1/2 inches in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Provide flanges of the weld neck type to match wall thickness of pipe.

3.7.2.1 Corrugated Stainless Steel Tubing (CSST)

NOTE: Delete this paragraph if CSST is not part of the design. If CSST is included in the design, ensure the location is suitable. Properly bond and ground CSST from other metals. Coordinate CSST design with NFPA 54 requirements (partition penetration protection, etc). Ensure hanger spacing complies with manufacturer's instructions and not standard piping spacing.

Determine and establish the length of each tubing run at the job site between each two points of connection within the piping system by the payout of the tubing from its supplied storage spool. For all tubing sizes, use the appropriate mechanical fittings as supplied by the tubing manufacturer. Submit a CSST Installation Guide which includes manufacturer's product data and installation instructions. Install CSST in accordance with manufacturer's instruction (including hanger spacing). Where differences with the manufacturer's installation instruction differ with NFPA 54, install CSST in accordance with NFPA 54.

3.7.2.1.1 Mechanical Joints

Prepare the tubing end and assemble the fitting on the tubing in accordance with the tubing manufacturer's instructions. Apply the manufacturer specified torque to the fitting to complete the assembly process. Do not use sealant or tape within the fitting where it attaches to the tubing. Apply approved sealant and/or tape to the tapered male pipe thread portion of the fitting before it can be assembled with any other steel and/or malleable iron pipe component/fitting.

3.7.2.1.2 Tubing Size Changes

Use appropriate reducing or expansion fittings as supplied by the manufacturer or standard malleable iron fittings for changes in tubing size.

3.7.2.1.3 Identification of Tubing

Identify and mark all CSST tubing in accordance with the requirements of ANSI LC 1/CSA 6.26. No other identification is required.

3.8 PIPE JOINTS

Design and install pipe joints to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

3.8.1 Threaded Steel Joints

Provide threaded joints in steel pipe with tapered threads evenly cut, made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks is not permitted.

3.8.2 Welded Steel Joints

Perform gas pipe weldments, as indicated, by welders who have submitted certificates on file with the Contracting Officer to conform to this specification and as required in 49 CFR 192 and ASME B31.8. Make changes in direction of piping by welding 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 welding tees or forged branch outlet fittings. Use forged or flared branch outlet fittings for improvement of flow where attached to the run, and reinforced against external strains. Perform all beveling, alignment, and heat treatment in accordance with 49 CFR 192 and ASME B31.8. Remove weld defects and repair the weld, or remove the weld joints entirely and reweld. After filler metal has been removed from its original package, protect it or 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. Perform inspection of welds in accordance with 49 CFR 192, Subpart E, and ASME B31.8.

3.8.3 Polyethylene Pipe Jointing Procedures

Use jointing procedures conforming to AGA XR0603 and 49 CFR 192 that have been qualified by test in accordance with 49 CFR 192.283 and proven to make satisfactory joints. Personnel make joints in plastic pipe must be qualified in accordance with 49 CFR 192.285, under the submitted and approved procedure by making a satisfactory specimen joint that passes the required inspection and test. Joints in plastic pipe must be inspected by a person qualified by 49 CFR 192.287 under the applicable procedure. Certificates that qualify the applicable procedures, joining personnel, and inspectors must be submitted and approved and must be on file with the Contracting Officer prior to making these joints.. Avoid making indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer if other alternative joining procedures are available. If heat fusion joining of dissimilar polyethylene is required, special procedures are required. Test the method of heat fusion joining dissimilar polyethylene resins in accordance with paragraph TESTS, subparagraph Destructive Tests of Plastic Pipe Joints.

3.8.4 Connections Between Metallic and Plastic Piping

Only make metallic to plastic connections outside, underground, and with approved transition fittings.

3.9 VALVE BOXES

Provide valve boxes of cast iron not less than 4.7 mm 3/16 inch thick at each underground valve except where concrete or other type of housing is indicated. Provide valve boxes with locking covers that require a special wrench for removal, and furnish the correctly marked wrench for each box. Cast the word "gas" in the box cover. When the valve is located in a roadway, protect the valve box by a suitable concrete slab at least 1 square meter 3 square feet. When in a sidewalk, provide the top of the box as a removable concrete slab 600 mm 2 feet square and set flush with the sidewalk. Make the boxes adjustable extension type with screw or slide-type adjustments. Separately support valve boxes to not rest on the pipe, so that no traffic loads can be transmitted to the pipe. Only locate valves valve boxes or inside of buildings.

3.10 DRIPS

NOTE: If gas mains are for the distribution of high-pressure natural gas (above 400 kPa 60 psig) only, delete the entire paragraph: DRIPS. Require drips for lines transmitting natural gas at the low point immediately following reduction from high pressure (above 400 kPa 60 psig) to medium pressure (400 kPa (60 psig or less), and at occasional low points throughout the system, to provide for blowing out the lines. Require drips at all low points in lines transmitting manufactured gas or a mixture of manufactured and natural gas. Indicate locations of drips. Locate drip points to provide for proper drainage of pipe system. Detail drips and discharge terminal (outlet) piping. If the need to contain and dispose of liquids through the valve for environmental concerns is required, delete the first bracketed sentence.

Install drips conforming to the details, provide commercial units of approved type and capacity. Connect a blow off pipe 32 mm 1-1/4 inches or larger to each drip at its lowest point and extend to or near the ground surface at a convenient location away from traffic. Provide a reducing fitting for each discharge at each drip terminal (outlet), a plug valve, and a 15 mm 1/2 inch nipple turned down. Locate the discharge terminal (outlet) inside a length of 300 mm 12 inches or larger vitrified clay pipe, concrete sewer pipe or concrete terminal box [set vertically on a bed of coarse gravel 300 mm 1 foot thick and 1 m3 feet square,] [with concrete bottom to contain liquids and a connection to remove liquids for disposal,] and closed at the ground surface with a suitable replacement cover.

3.11 PRESSURE REGULATOR INSTALLATION

3.11.1 Main Distribution Line Regulators

NOTE: Remove reference to bypasses around pressure regulators for main distribution lines unless continuity of service is imperative and the bypass is regulated to prevent possible overpressure of downstream lines.

Install pressure regulators. Install a valve on each side of the regulator for isolating the regulator for maintenance.[Provide a bypass line with bypass valves or 3 way valves and an over-pressurization pressure regulating device.] Install regulators and valves in rectangular reinforced concrete boxes, large enough so that all required equipment can be properly installed, operated, and maintained, with box sidewalls extending above ground line. Provide the boxes with [steel door] [cast iron manhole] covers with locking provisions and 100 mm 4 inch diameter vents. Furnish one key or other unlocking device with each cover. Locate discharge stacks, vents, or outlet ports of all pressure relief devices where gas can be discharged into the atmosphere without undue hazard. Provide stacks and vents with fittings to preclude entry of water.

3.11.2 Service Line Regulators

NOTE: Delete inapplicable requirements.

Install a shutoff valve,[meter set assembly,] and service regulator on the service line outside the building, 450 mm 18 inches above the ground on the riser. Install an insulating joint on the inlet side of the [meter set assembly and] service regulator and construct to prevent flow of electrical current. Provide a 10 mm 3/8 inch tapped fitting equipped with a plug on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. 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.

3.12 METER INSTALLATION

NOTE: Air Force Engineering Technical Letter Number 87-5 "Utility Meters in New and Renovated Facilities" provides guidance for when to exclude meters from Air Force new and major renovation projects. Review the requirements for gas meters in TI 800-01 Design Criteria and 10 CFR 435.

Install meters in accordance with ASME B31.8. Install permanent gas meters with provisions for isolation and removal for calibration and maintenance, and suitable for operation in conjunction with an energy monitoring and control system.

3.13 CONNECTIONS TO EXISTING LINES

NOTE: If connections to existing mains are required, retain this subparagraph, and select the appropriate Paragraph. Drawings will show existing gas lines when interface with the existing gas system is required.

Make connections between new work and existing gas lines, where required, in accordance with ASME B31.8, using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, provide the same size connecting fittings as the pipe being connected.

3.13.1 Connections to Publicly or Privately Operated Gas Utility Lines

NOTE: Delete inapplicable requirements.

Provide materials for the connections to the existing gas lines. The Utility is to make final connections and turn on the gas. The Utility is to also disconnect, purge and cap, plug or otherwise effectively seal existing lines that are to be abandoned or taken out of service. Notify

the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. Make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. Furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

3.13.2 Connection to Government Owned/Operated Gas Lines

NOTE: Provide the name and location of the Utility or Operating Agency of the existing gas lines. Show on the drawings, the location of valves to be operated for existing system deactivation. When lines are to be abandoned, give consideration to any effects the abandonment may have on an active cathodic protection system and take appropriate action. If the segment is long and there are few line valves, give consideration to plugging the abandoned segment at intervals.

Provide connections to the existing gas lines in accordance with approved procedures. Only perform deactivation of any portion of the existing system at the valve location indicated. Reactivation of any existing gas lines will only be done by the [Government] [local Utility] [Operating Agency]. Submit the approved Connection and Abandonment Plan prior to making any connections to existing gas lines, manicure the [Operating Agency's] [Utility's] required procedures which may be obtained from [_____]. Notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

- a. Physically disconnect from the pipeline system if facilities are abandoned in place. Purge, cap, plug or otherwise effectively seal the open ends of all abandoned facilities. Do not complete abandonment until it has been determined that the volume of gas or liquid hydrocarbons contained within the abandoned section poses no potential hazard. Use air or inert gas for purging, or fill the facility with water or other inert material. If air is used for purging, ensure that a combustible mixture is not present after purging.
- b. When a main is abandoned, together with the service lines connected to it, seal only the customer's end of such service lines as stipulated above.
- c. Disconnect abandoned service lines from the active mains as close to the main as practicable.
- d. Close all valves left in the abandoned segment.
- e. Remove all above grade valves, risers, and vault and valve box covers. Fill vault and valve box voids with suitable compacted backfill material.

3.14 CATHODIC PROTECTION

NOTE: Cathodic protection is mandatory for underground metallic gas distribution lines. Select

the type and design of cathodic protection in accordance with UFC 3-570-02A. Provide testing stations for the cathodic protection system.

Provide cathodic protection for all metallic gas piping installed underground and install 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)].

3.15 TESTS

3.15.1 Destructive Tests of Plastic Pipe Joints

NOTE: Destructive tests of plastic pipe joints are provided as required by 49 CFR 192 and ASME B31.8. These requirements must be met in order to be accepted by Utility Privatization Contractors.. Destructive tests are considered useful in assuring that good joints will be made. Delete the paragraph if this option is not exercised.

Prior to making polyethylene heat fusion joints, make a joint of each size and type to be installed that day by each person performing joining of plastic pipe that day and destructively test. Cut at least 3 longitudinal straps from each joint. Visually examine each strap for voids or discontinuities on the cut surfaces of the joint area, deformations by bending, torque, or impact. Failures are not permitted in the joint area. If a joint fails the visual or deformation test, the qualified joiner who made that joint is not allowed to make further field joints in plastic pipe on this job until that joiner has been retrained and re-qualified. Record the results of the destructive tests including the date and time of the tests, size and type of the joints, ambient conditions, fusion iron temperature and names of inspectors and joiners.

3.15.2 Pressure and Leak Tests

NOTE: Specify correct test pressure (including Class Location) to be used for tests of gas line systems in accordance with ASME B31.8. Specify correct test pressure (including Class Location) to be used for tests of gas line systems in accordance with NFPA 58. Test pressures should recognize the weakest component of each system tested for the design pressure, the maximum allowable operating pressure, and the gas supplier's maximum operating pressure.

The test pressure will be 150 percent of the maximum operating pressure or 350 kPa 50 psig, whichever is greater. However, the maximum test pressure must not be more than three times the design pressure of the pipe.

Test the system of gas mains and service lines after construction and

before being placed in service, using air as the test medium. Follow all testing recommendations and safety precautions as recommended by the piping manufacturer's specifications, [NFPA 54][,][NFPA 58][and][49 CFR 192]. Submit data in booklet form from all pressure tests of the distribution system. Perform testing for polyethylene (PE) piping in accordance with ASTM F2786. The normal operating pressure for the system is [_____]. The test pressure is [_____].

- a. Prior to testing the system, blow-out, clean, and clear the interior of all foreign materials. Remove all meters, regulators, and controls before blowing out and cleaning, and reinstall after clearing of all foreign materials.
- b. Perform testing of gas mains and service lines with due regard for the safety of employees and the public during the test. Keep persons not working on the test operations out of the testing area while testing is proceeding. Perform the test on the system as a whole or on sections that can be isolated.
- c. Test joints in sections prior to backfilling when trenches are to be backfilled before the completion of other pipeline sections. Continue the test for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. Do not take the initial test readings of the instrument for at least 1 hour after the pipe has been subjected to the full test pressure. Do not take initial or final readings at times of rapid changes in atmospheric conditions, and temperatures are representative of the actual trench conditions. No indication of reduction of pressure is allowed during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2)=T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings.
- d. During the test, completely isolate the entire system from all compressors and other sources of air pressure. Test each joint by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. Secure approval of testing instruments from the Contracting Officer. Furnish all labor, materials and equipment for conducting the tests subject to inspection at all times during the tests. Maintain safety precautions for air pressure testing at all times during the tests.

3.15.3 Meter Test

Test meter to verify data transfer to data collection server and validate calibration of both meter and the data that is received by the data collection server.

3.16 MAINTENANCE

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, in three separate packages. Submit Data packages, as specified.

3.16.1 Gas Distribution System and Equipment Operation

Include maps showing piping layout, locations of system valves, gas line markers and cathodic protection system test stations; step-by-step procedures for system start up, operation and shutdown (index system

components and equipment to the system maps); 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 per Section 01 78 23.

3.16.2 Gas Distribution 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 per Section 01 78 23.

3.16.3 Gas Distribution Equipment Maintenance

Include identification of valves 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 per Section 01 78 23.

-- End of Section --