UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025
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USACE / NAVFAC / AFCEC | **UFGS-33 51 15 (August 2019)**

Preparing Activity: USACE | **Superseding UFGS-33 51 15 (February 2016)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025

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SECTION 33 51 15

NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES
08/19

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NOTE: This guide specification provides requirements for distribution pipelines that convey natural gas, manufactured gas, or Liquefied Petroleum Gas (LPG) in the vapor phase in order to comply with the regulations written in 49 CFR 192. LPG vapor distribution pipelines must additionally comply with the requirements of NFPA 58, as is required by 49 CFR 192.

Where LPG tanks have remote filling piping system that can contain LPG in the liquid phase, please refer to UFC 4-60-01, Design: Petroleum Fuel Facilities, for required design elements.

Gas piping that serves a building, downstream from the 49 CFR 192 pipeline, is to be specified in Section 23 11 20 FACILITY GAS PIPING, and must be designed in accordance with NFPA 54.

LPG piping and storage tank that serves a single building are to be specified in Section 23 11 20 FACILITY GAS PIPING and must be designed in accordance with NFPA 58 and NFPA 54.

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 pipeline includes piping that conveys [natural gas] [manufactured gas] [liquefied petroleum gas (LPG) in its vapor phase] and all appurtenances from point of connection with existing system, to a point approximately [1500] [_____] mm [5] [_____] feet from the facility being served. The distribution pipeline, which must comply with 49 CFR 192, terminates at the isolation valve, service pressure regulator, or meter, whichever is the most downstream component before serving the facility gas piping. The facility gas piping that connects to this termination point is specified in Section 23 11 20 FACILITY GAS PIPING and must comply with NFPA 54.

Section 31 10 00 SITE CLEARING, applies to this section unless otherwise specified.

1.2 REFERENCES

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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.

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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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.18/CSA 6.3	(2019; R 2024) Gas Appliance Pressure Regulators
ANSI Z21.80/CSA 6.22	(2019; R 2024) Line Pressure Regulators

AMERICAN PETROLEUM INSTITUTE (API)

API API-ASME CODE	(1951) Unfired Pressure Vessels for Petroleum Liquids and Gases
API RP 686	(2009) Recommended Practice for Machinery Installation and Installation Design
API Spec 5L	(2018; 46th Ed; ERTA 2018) Line Pipe
API Spec 6D	(June 2018, 4th Ed; Errata 1 July 2018; Errata 2 August 2018) Specification for Pipeline and Piping Valves
API Std 617	(2014; 8th Ed; ERTA 1 August 2016) Axial and Centrifugal Compressors and Expander-Compressors
API Std 618	(2007; R 2016) Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services
API Std 619	(2010) Rotary-Type Positive Displacement Compressors for Petroleum, Petrochemical, and Natural Gas Industries

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 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

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 B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2024) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2022) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.25	(2022) Buttwelding Ends
ASME B16.40	(2024) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B31.8	(2022; Supplement 2022) Gas Transmission and Distribution Piping Systems
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII	(2010) Boiler and Pressure Vessel Codes: Section VIII Rules for Construction of Pressure Vessel
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME PTC 25	(2023) Pressure Relief Devices

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2022; E 2022) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2024) Standard Specification for Pipe,

	Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2019a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A181/A181M	(2014; R 2020) 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 A395/A395M	(1999; R 2022) Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM D2513	(2018a) Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
ASTM D2513-99	(1999) Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2517	(2018) Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM D2683	(2020) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2774	(2021a) Standard Practice for 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; R 2017) Standard Specification for PTFE Resin Skived Tape
ASTM D3350	(2021) Polyethylene Plastics Pipe and Fittings Materials
ASTM D3839	(2014; R 2019) Standard Guide for Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3892	(2015) Standard Practice for Packaging/Packing of Plastics

ASTM D4066	(2013) Standard Classification System for Nylon Injection and Extrusion Materials (PA)
ASTM D5685	(2019) Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings
ASTM F1055	(2016; R 2022a) Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX)Pipe and Tubing
ASTM F1802	(2022) Standard Test Method for Performance Testing of Excess Flow Valves
ASTM F1948	(2015) Standard Specification for Metallic Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing
ASTM F1973	(2013; R 2018) Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems
ASTM F2138	(2012; R 2024) Standard Specification for Excess Flow Valves for Natural Gas Service
ASTM F2145	(2013; R 2018) Standard Specification for Polyamide 11 (PA 11) and Polyamide 12 (PA 12) Mechanical Fittings for Use on Outside Diameter Controlled Polyamide 11 and Polyamide 12 Pipe and Tubing
ASTM F2164	(2021) Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
ASTM F2600	(2009; R 2018) Standard Specification for Electrofusion Type Polyamide-11 Fittings for Outside Diameter Controlled Polyamide-11 Pipe and Tubing
ASTM F2620	(2024) Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
ASTM F2786	(2010) Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Media Under Pressure (Pneumatic Leak Testing)
ASTM F2897	(2015a) Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components

	(Pipe, Tubing, Fittings, Valves, and Appurtenances)
ASTM F2945	(2018) Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings

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-142	(2012) Excess Flow Valves for Fuel Gas Service, NPS 1 1/2 through 12

MASTER PAINTERS INSTITUTE (MPI)

MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 10	(2016) Latex, Exterior Flat (MPI Gloss Level 1)
MPI 11	(2016) Latex, Exterior Semi-Gloss, MPI Gloss Level 5
MPI 119	(2016) Latex, Exterior, Gloss (MPI Gloss Level 6)

NACE INTERNATIONAL (NACE)

NACE SP0169	(2024) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0185	(2024) 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	(2024) National Fuel Gas Code
NFPA 58	(2024; TIA 24-2) Liquefied Petroleum Gas Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) 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	(2024) 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
49 CFR 192.105	Design Formula for Steel Pipe
49 CFR 192.197	Control of the Pressure of Gas Delivered from High-Pressure Distribution Systems

UL SOLUTIONS (UL)

UL 125	(2020) UL Standard for Safety Flow Control Valves for Anhydrous Ammonia and LP-Gas
UL 132	(2015; Reprint Jan 2018) UL Standard for Safety Relief Valves for Anhydrous Ammonia and LP-Gas
UL 144	(2012; Reprint Nov 2014) UL Standard for Safety LP-Gas Regulators
UL 569	(2013; Repring Jul 2017) UL Standard for Safety Pigtails and Flexible Hose Connectors for LP-Gas

1.3 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 and Air Force 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.

****

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. Submittals not having a "G" or "S" classification are 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

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 and qualifications

Jointing of Plastic Piping

Utility Work

SD-08 Manufacturer's Instructions

EFV Design and 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. Qualification of welding procedures and Welder's training and qualifications, including equipment used, detailed explanation of the procedure, and successfully making joints which pass tests must comply with Subpart E of 49 CFR 192.

b. Submit procedures for welding of metallic piping that comply with API Std 1104 section 5, 12, or App. A; or ASME BPVC SEC IX. Quality of test welds used to qualify a procedure must be determined by destructive test. Submit the results of destructive testing of each procedure qualification for Government record.

c. Submit a certificate of Welder's training and qualifications by test, requalification, or production work testing in conformance with API Std 1104 section 6, 12, or App. A; ASME BPVC SEC IX; or as allowed per 49 CFR 192 Appendix C.

d. Submit a list of names and identification symbols for all qualified welders and welding operators to be used on the project.

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

1.4.1.2 Jointing of Plastic Piping

a. Join piping by performance qualified plastic pipe joiners, qualified by a person who has been trained and certified by the manufacturer of the pipe, using manufacturer's pre-qualified joining procedures that have been tested in accordance with 49 CFR 192 Subpart F. Inspect joints by an inspector qualified in the joining procedures being used.

b. Submit manufacturer's pre-qualified joining procedures and the results of testing performed to 49 CFR 192 Section 283.

c. Plastic pipe joiners must be re-qualified at the beginning of each project by making specimen joints using the approve procedures and having those joints inspected by a qualified inspector and tested in accordance with 49 CFR 192 Section 285.

d. 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. ASME B31.8 may be used to help develop these plans, but the connection and abandonment must comply with 49 CFR 192. 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 coated steel piping in accordance with its listing and the manufacturer's written procedures. Handle plastic pipe in conformance with AGA XR0603.

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 LPG CONTAINERS

Provide containers for LPG that meet NFPA 58 requirements and are designed, fabricated, tested, and marked in accordance with the regulations of the department of transportation (DOT), ASME BPVC SEC VIII, or API API-ASME CODE. Provide LPG containers with all appurtenances as required by NFPA 58, qualified to UL 125, to include vapor shutoff valve, liquid shutoff valve, pressure relief valve, fixed maximum liquid level gauge, filler valve, [and overfilling protection device,][and actuated liquid withdrawal excess-flow valve]. Container appurtenances must have a minimum service pressure rating of 1.7 MPa250 psig.

]2.2 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

[Provide only materials that are allowed for [natural gas][manufactured gas] by 49 CFR 192 for the specified distribution pipeline being installed.]

[Provide only materials that are allowed by LPG by NFPA 58 for the specified disbribution pipeline being installed.]

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. Electrical Isolation Devices and Isolating Flange Kits.
b. Fittings
c. Piping
d. Pipe and Accessory coatings
e. Pressure Reducing Valves.
f. Meters
g. Regulators.
h. Shut-off Valves
i. Excess Flow Valve
[j. LPG Containers]

2.2.1 Steel Pipe for [Natural Gas][Manufactured Gas] Distribution

****
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.
****

Provide steel piping that complies with API Spec 5L, Grade [A,] B, or X42; ASTM A53/A53M, Grade[A or] B; ASTM A106/A106M, Grade [A][B or] C; ASTM A333/A333M, Grade [1 or] 3. Determine minimum pipe wall thickness as specified in 49 CFR 192.105 section "Design Formula for Steel Pipe" for the specific design conditions. [Pipe wall thickness less than schedule 80 for pipes less than 2.5 inches diameter is not permitted.]

[2.2.2 Steel Pipe for LPG Distribution

****
NOTE: LPG piping systems covered by this specification must be designed to prevent LPG in the liquid phase from being trapped between isolation valves. NFPA 58 requires any LPG piping system that can trap liquid LPG to be rated for 2.4 MPa350 psig and to contain a hydrostatic pressure relief valve.
****

Provide steel piping that is approved within NFPA 58 and complies with ASTM A53/A53M, Grade [A or] B; ASTM A106/A106M, Grade [A,][B, or] C. Provide pipe wall thickness as specified on the design drawings, but in no

case less than schedule 40. Provide schedule 80 pipe where threads are to be cut in order to connect threaded valves or appurtenances.

]2.2.3 Corrosion Protection for Steel Pipe for Underground Installation

2.2.3.1 External Coating Systems

****
NOTE: Delete this paragraph where steel pipe is not installed underground as neither a gas carrier pipe nor as an encasement for plastic pipe.
****

****
NOTE: This paragraph must be retained where steel pipe is used to encase a plastic gas carrier pipe.
****

Where steel pipe installation below ground is required by design of the gas carrier pipe, or as encasement for plastic pipe, provide pipe with a [factory applied][field plant applied] polyolefin resin coating system conforming to NACE SP0185, Type A. Pipe exterior must be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6/NACE No.3. Apply adhesive compound to the pipe with a nominal thickness of 0.25 mm10 mils (plus or minus 10 percent). Immediately after the adhesive is applied, extrude a seamless tube of polyolefin over the adhesive to produce a bonded seamless coating, with a nominal thickness of 1.0 mm40 mils (plus or minus 10 percent) of polyolefin resin for pipes up to 400 mm16 inches in diameter. For pipes 450 mm18 inches and larger in diameter, apply a minimum thickness of 60 mils (plus or minus 10 percent) polyolefin resin.

Do not coat pipe and fittings for aboveground lines.

2.2.3.2 Cathodic Protection Systems

Provide cathodic protection system in accordance with NACE SP0169 and the applicable UFGS DIV 26 specification for the designed type of cathodic protection.

2.2.4 Steel and Malleable Iron Fittings, 40 mm1-1/2 inches and Smaller

Provide steel butt-weld fittings conforming to ASME B16.9 [or threaded malleable iron fittings for [natural gas][manufactured gas] pipe conforming to ASME B16.11].

[Provide fittings for LPG piping systems that are rated for a minimum of [863 kPa125 psig][1725 kPa250 psig] and comply with NFPA 58. Threaded fittings must be qualified by the manufacturer for use with LPG. Use threaded fittings in an LPG pipeline only at connecting equipment and appurtenances that are provided by the manufacturer with threaded connections.]

2.2.5 Steel Fittings, 50 mm 2 inches and Larger

Provide weld neck pipe flanges and flanged fittings, including bolts, nuts, and bolt patterns in accordance with ASME B16.5, Class [150][_____]. Provide buttweld fittings in accordance with ASME B16.9.

[Provide fittings for LPG piping systems that are rated for a minimum of [863 kPa125 psig][1.7 MPa250 psig] and comply with NFPA 58.]

2.2.6 Steel Forged Branch Connections

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

2.2.7 Flange Gaskets

[Provide gaskets for [natural][manufactured] gas systems that are 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.]

[Provide gaskets for LPG systems constructed of metal or confined by metal that has a melting point above 815 degrees C1,500 degrees F and is resistant to the action of LPG and in accordance with NFPA 58.]

2.2.8 Pipe Threads

[Provide pipe threads for [natural][manufactured] gas piping conforming to ASME B1.20.2MASME B1.20.1.]

[Provide only fittings manufactured for the purpose of threaded connections made in LPG piping systems. Design threaded fittings in LPG systems for no less than 250 psig operating pressure.]

****

NOTE: Delete the paragraph below where LPG distribution systems are specified. NFPA 58 does not allow thread sealant compounds or tape to be used in LPG piping systems. Where sealing at the threads of a connection in an LPG pipeline is necessary, specify back welding of the threaded joint using minimum schedule 80 piping and 1.7 MPa 250 psig rated fittings.

****

2.2.9 Sealants for Steel Pipe Threaded Joints in [Natural][Manufactured] Gas Systems

2.2.9.1 Sealing Compound

Provide joint sealing compound as listed in UL FLAMMABLE & COMBUSTIBLE, Class 20 or less that is qualified for use with [natural gas] [manufactured gas].

2.2.9.2 Tape

Provide polyetrafluoroethylene tape conforming to ASTM D3308 that is qualified for use with [natural gas][manufactured gas].

2.3 PLASTIC PIPE, TUBING, FITTINGS AND JOINTS

****

NOTE: Before selecting plastic 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 plastic pipe material based on the gas analysis.

Polyethylene, per ASTM D2513, is the preferred plastic pipe material. SDR-11 wall thickness is the minimum allowed on a Government Installation. SDR is the nominal pipe diameter divided by the wall thickness. Higher SDR-# means thinner wall. Lower SDR-# means thicker wall. Therefore, SDR-9 would be allowed; while SDR-13 must be disapproved.

Polyamide-11 (PA-11), per [ASTM D2513-99][ASTM F2945], may be used only to connect to existing pipelines constructed of PA-11. PA-11 plastic cannot be connected by heat fusion to any other plastic and the Government will not allow a mechanical connection for this purpose.

Reinforced epoxy resin pipe, per ASTM D2517, may be used only to connect to existing natural or manufactured gas pipelines constructed of reinforced epoxy resin pipe. Reinforced epoxy resin pipe is not qualified for use with LPG per NFPA 58.

Do not use plastic material for gas pipelines with design pressures above 690 kPa100 psig, unless the manufactured products meet the requirements specified 'Design Limitations for Plastic Pipe', Section 192.123 of 49 CFR 192.

Do not use plastic material in gas pipelines where operating temperatures may exceed the material's qualified temperature range. PE and PA-11 materials must not exceed the temperature used to determine the Hydrostatic Design Basis (HDB) that was used to calculate the design pressure of the pipeline per section 192.121 of 49 CFR 192. Reinforced epoxy resin pipelines must not exceed 66 degrees C150 degrees F.

Do not use plastic material in pipelines where operating temperature may be below -29 degrees C-20 degrees F without consulting section 192.123 of 49 CFR 192 and the manufacturer of the pipe and fittings.

****

2.3.1 Polyethylene Gas Pressure Pipe, Tubing, and Fittings

Provide polyethylene (PE) pipe, tubing, fittings conforming to ASTM D2513, as specified in 49 CFR 192 Appendix B and manufactured using material that complies with ASTM D3350. Pipe wall thickness must comply with the Standard Dimension Ratio, SDR-11, or lower value, meaning thicker wall. The Hydrostatic Design Basis (HDB) of the selected PE material must exceed the Maximum Allowable Operating Pressure (MAOP), at the anticipated operating temperature of the system in which it is installed. Mark pipe, tubing, and fittings as required by ASTM D2513 and with traceability code

per ASTM F2897.

Provide polyethylene fittings that are constructed of polyethylene of the same material classification and SDR as the connecting pipe, and comply with ASTM D2513. Provide fittings with [butt-type fusion fittings complying with ASTM D3261][socket-type fusion fittings complying with ASTM D2683][electrofusion-type fittings complying with ASTM F1055].

Where mechanical fittings are specified on the engineering drawings, provide mechanical fittings that comply with ASTM F1948 and are category 1 for pressure integrity, gas tightness, and provide pull-out resistance equivalent to the pipe strength.

Provide heat fusion joints complying with ASTM F2620 and the manufacturer's written procedure approved by the contracting officer. Electro fusion joints fittings must comply with ASTM F1055 and the manufacturer's written procedure approved by the contracting officer. Perform underground installations in conformance with ASTM D2774.

2.3.2 Polyamide-11 Gas Pressure Pipe, Tubing, and Fittings

****

NOTE: Remove this paragraph where the existing distribution system that is being connected to is not Polyamide-11 pipe. Please note that 49 CFR 192 references ASTM D2513, revision dated 1999, i.e, ASTM D2513-99 for PA-11 pipe, tube, and fittings. This reference will remain until 49 CFR 192 recognizes ASTM F2945 as the standard for PA-11 pipe, tube, and fittings. It is recommended that a dual reference for ASTM D2513-99 and ASTM F2945 be retained until 49 CFR 192 is revised to reference ASTM F2945.

****

Use PA-11 pipe to connect only to existing gas distribution pipelines that are constructed of PA-11.

Provide PA-11 pipe, tubing, fittings and joints conforming to [ASTM D2513-99] [ASTM F2945], as specified in 49 CFR 192 Appendix B and manufactured using material that complies with ASTM D4066. Pipe wall thickness must comply with the Standard Dimension Ratio, SDR-11, or lower value, meaning thicker wall. The Hydrostatic Design Basis (HDB) of the selected PA-11 material must exceed the Maximum Allowable Operating Pressure (MAOP), at the anticipated operating temperature of the system in which it is installed. Mark pipe, tubing, and fittings as required by [ASTM D2513-99] [ASTM F2945] with traceability code per ASTM F2897.

Provide PA-11 fittings that are constructed of PA-11 of the same material classification and SDR as the connecting pipe and comply with [ASTM D2513-99] [ASTM F2945]. Provide [butt-type fusion fittings complying with [ASTM D2513-99] [ASTM F2945],[Annex A2] [electro fusion-type fusion fittings complying with ASTM F2600]].

Where mechanical fittings are specified on the engineering drawings, provide mechanical fittings that comply with [ASTM F1948 for metallic mechanical fittings] [ASTM F2145 for PA-11 bodied mechanical fittings] and are category 1 for pressure integrity, gas tightness, and provide pull-out resistance equivalent to the pipe strength.

Make heat fusion joints and electro fusion joints in accordance with the manufacturer's written procedure approved by the contracting officer. Perform underground installations in conformance with ASTM D2774.

[2.3.3 Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

****

NOTE: Remove this paragraph when specifying LPG distribution pipelines or where the existing distribution system that is being connected to is not reinforced epoxy resin pipe complying with ASTM D2517.

****

Use reinforced epoxy resin pipe to connect only to existing [natural gas][manufactured gas] distribution pipelines that are constructed of reinforced epoxy resin.

Provide reinforced epoxy resin pipe, tubing, fittings conforming to ASTM D2517 and as specified in 49 CFR 192 Appendix B. Minimum wall thickness must comply with engineering drawings and 49 CFR 192. Mark pipe, tubing, and fittings as required by ASTM D3892.

Provide fittings conforming to ASTM D5685.

Adhesives used to join pipe and fitting must comply with ASTM D2517 and the manufacturer's written procedure approved by the contracting officer. Perform underground installations in conformance with ASTM D3839.

]2.3.4 Mechanical Fittings for use with Plastic Pipe

Use of mechanical fittings in distribution pipelines constructed of plastic requires the approval of Engineering and the Contracting Officer. Mechanical fittings may be approved only where others methods of connecting piping and appurtenances will produce a less reliable gas tight connection.

Mechanical fittings, their use, and installation must comply with 49 CFR 192. Mechanical fittings must meet the requirements of category 1 presented in [ASTM F1948 for metallic mechanical fittings] [ASTM F2145 for PA-11 mechanical fittings] to remain gas tight while resisting pull-out forces.

Mechanical fittings constructed of metal or plastic other than the plastic specified for piping must be approved base on submission of manufacturer's test data and historical service records indicating their acceptability for the intended service.

Submit all traceability information for each mechanical fittings to include, but not limited to, the manufacturer, part number, serial number, and geographic information system coordinates of the installed location.

[2.4 FLEXIBLE METALLIC CONNECTORS FOR LPG SERVICE

Where flexible piping is required for connection of LPG container regulator to the manual shut off valve at the start of the LPG pipeline, provide flexible metallic connectors complying with UL 569, rated for a working pressure not less than 2.4 MPa350 psig. Provide hose assembly

with approved connectors that is designed for a pressure not less than 4.8 MPa700 psig.

]2.5 VALVES

****

NOTE: Valves and pressure regulators are necessary at all points where design requires pressure reduction or regulation. Require a shut-off valve in compliance with the requirements of 49 CFR 192.197. 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.

****

[2.5.1 Carbon Steel Valves for [Natural Gas][Manufactured Gas] Pipelines

Provide valves suitable for shutoff or isolation in [natural] [manufactured] gas pipelines conforming to the requirements of 49 CFR 192. All materials used in valve construction must be resistant to the action of the gas being distributed under the service conditions.

Provide carbon steel valves installed in [natural gas][manufactured gas] pipelines that comply with API Spec 6D. Provide ball, check, gate, and plug valves as specified in the design drawings.

Provide Class [150][_____] steel valves 40 mm1-1/2 inches and smaller installed underground with butt-weld ends complying with ASME B16.25, with square wrench operator adaptor and corrosion prevention.

Provide Class [150][_____] steel valves 40 mm1-1/2 inches and smaller installed aboveground with butt-weld complying with ASME B16.25 or threaded ends complying with ASME B1.20.1, with hand wheel or wrench operator.

Provide Class [150][_____] steel valves 50 mm2 inches and larger installed underground with butt-weld ends complying with ASME B16.25, and square wrench operator adaptor and corrosion prevention coating.

Provide Class [150][_____] steel valves 50 mm2 inches and larger installed aboveground with butt-weld complying with ASME B16.25 or flanged ends complying with ASME B16.5, with hand wheel or wrench operator.

Provide valves 200 mm8 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.

][2.5.2 Metallic Valves for LPG Pipelines

Provide manual shut-off valves, excess flow valves, and backflow check valves in LPG pipelines conforming to the requirements of NFPA 58 and UL 125. Provide valves constructed from [steel,] [ductile (nodular) iron complying with ASTM A395/A395M,] [malleable iron complying with ASTM A47/A47M,] [brass]. All materials used in valve construction must be resistant to the action of LPG under the service conditions. Valves must have a service pressure rating of [0.9 MPa125 psig for pipeline pressure of 0.9 MPa125 psig or less] [and] [1.7 MPa250 psig for pipelines operating above 0.9 MPa125 psig].

[Provide pressure spring loaded relief valves that comply with UL 132 with flow capability to limit the pressure in the pipeline to below the Maximum Allowable Operating Pressure (MAOP) for the system.]

]2.5.3 Plastic Valves for [Natural Gas][Manufactured Gas][LPG] Pipelines

[Provide valves installed in polyethylene distribution pipelines that are constructed of polyethylene of the same material classification and SDR as the connecting pipe. Comply with ASTM D2513 and ASME B16.40 for underground installation only. Provide valves with [butt-type fusion fittings complying with ASTM D3261] [socket-type fusion fittings complying with ASTM D2683][electro fusion-type fittings complying with ASTM F1055].]

[Provide valves installed in PA-11 distribution pipelines that are constructed of PA-11 of the same material classification and SDR as the connecting pipe. Comply with [ASTM D2513-99] [ASTM F2945] and ASME B16.40 for underground installation only. Provide valves with [butt-type fusion fittings complying with [ASTM D2513-99] [ASTM F2945], Annex A2] [electro fusion-type fusion fittings complying with ASTM F2600].]

2.5.4 Excess Flow Valve (EFV)

Provide [bypass type EFV with automatic reset][non-bypass type EFV with manual rest] that conforms to MSS SP-142 and ASTM F2138 and tested to ASTM F1802. Submit an EFV Design and Installation Guide which includes the manufacturer's product design data and installation instructions. Submit all traceability information for each EFV to include, but not limited to, the manufacturer, part number, serial number, and geographic information system coordinates of the installed location. Provide appropriate valve box where access for maintenance or reset is required.

2.5.5 Valve Box

Provide [street valve box with cast-iron cover and two-piece 130 mm5-1/4 inch shaft-slip valve box extension][rectangular concrete valve box, sized large enough for removal of valve without removing box]. Cast the word "Gas" into the box cover. Use valve box for areas as follows:

a. Roads and Traffic Areas: Heavy duty, cast iron cover.

b. Other Areas: Standard duty, concrete cover.

[c. Airfields and Special Loadings: As detailed.]

2.6 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.

[2.6.1 LPG Main Regulators

****
NOTE: There are several methods of reducing and regulating the pressure of LPG within the distribution pipeline. The designer must specify the NFPA 58 compliant regulator or regulator combination that is appropriate for the LPG service that is provided.
****

LPG regulators must comply with UL 144 and NFPA 58. Line pressure regulators that comply with ANSI Z21.80/CSA 6.22 are not allowed in the LPG distribution pipeline, but are used in accordance with NFPA 54 to reduce a 17.8 kPa2 psig service line pressure to appliance regulator inlet pressure. Appliance regulators that comply with ANSI Z21.18/CSA 6.3 must not be used in an LPG distribution pipeline.

Provide LPG two stage regulator systems as required by NFPA 58:

a. Single stage regulators are not allowed in an LPG pipeline.

[b. Automatic changeover regulator incorporating an integral two stage regulator, with [integral pressure relief to limit second stage outlet pressure to 14 kPa2 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset] on the outlet of the second stage regulator, for use on multiple cylinder installation.]

[c. Integral two-stage regulator with means to determine the outlet pressure of the high pressure regulator, with [integral pressure relief to limit second stage outlet pressure to 14 kPa2 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset].]

[d. High pressure regulator installed on the LPG container with [integral][separate] relief valve, and a first stage regulator, with integral pressure relief, installed downstream of the high pressure regulator to serve multiple second stage regulators with [integral pressure relief to limit second stage outlet pressure to 14 kPa2 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset] on the outlet of the second stage regulator.]

[e. First stage regulator, 69 kPa10 psig maximum outlet pressure, with integral pressure relief, and a second stage regulator with [integral pressure relief to limit second stage outlet pressure to 14 kPa2 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset].]

[f. Integral 2 psi service regulator, 17 kPa2.5 psig maximum outlet pressure with [integral pressure relief to limit outlet pressure to 35 kPa5 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset].]

[g. 2 psi regulator system including a first stage regulator, 69 kPa10 psig maximum outlet pressure, with integral pressure relief, and a 2 psi regulator, 17 kPa2.5 psig maximum outlet pressure with [integral pressure relief to limit 2 psi regulator outlet pressure to 35 kPa5 psig when seat disc is remove and inlet pressure is 104 kPa15 psig][overpressure shutoff with manual reset].]

][2.6.2 [Natural][Manufactured] Gas Main Regulators

Provide pressure regulators for main gas distribution pipelines from a qualified manufacture of pipeline regulators. Equip distribution pipelines with regulators where that pipeline is supplied from a source of gas that is at higher pressure than the maximum allowable operating pressure of the distribution pipeline. Provide regulators of adequate capacity that are rated for the inlet pressure of the gas source and the anticipated operating temperature. In addition to the pressure regulating devices, provide a protective method to prevent overpressuring of the system in accordance with 49 CFR 192, Section 195. Suitable protective devices are as follows:

****

NOTE: The designer may design and specify the method and device used to create overpressure protection that complies with 49 CFR 192, or the designer may include all of the methods allowed in 49 CFR 192 to allow the contractor to select a cost effective method. However, the designer must coordinate this decision with the authorized Distribution System Operator to ensure compliance with locally adopted requirements or standards.

****

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 relief valves conforming to ASME PTC 25.

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.

][2.6.3 [Natural][Manufactured]Service Regulators

****

NOTE: 49 CFR 192 allows service regulators installed on service lines operating at 414 kPa60 psig or less to omit pressure relief. However, it is recommended that service regulators comply with the requirements of this UFGS paragraph, as written, to allow the natural gas distribution pipeline operator the maximum flexibility in selecting higher distribution pipeline operating pressures.

Select one of the three bracketed texts to allow distribution pipeline operation between 414 kPa60 psig and 862 kPa125 psig.

Where the service regulator pipe connection exceeds 50 mm2 inches, one of the overpressure protection methods presented in the three bracketed texts is required by 192.197(b)

****

Provide ferrous bodied service regulators conforming to AGA ANSI B109.4 with [full capacity internal relief] [downstream pressure relief valve where distribution pipeline pressure does not exceed 862 kPa125 psig] [downstream automatic overpressure shut-off].

Service regulators must meet each of the following requirements.

a. Capable of reducing distribution line pressure to the safe pressure required by the connected equipment.

b. Capable of limiting, under no flow conditions, the build-up of downstream pressure that would cause unsafe operation of the connected equipment.

c. Pipe connections of 50 mm2 inches or less.

d. Single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet.

e. Valve seat of resilient materials designed to withstand flow conditions when pressed against the valve port.

f. Self-contained with no external static or control lines.

Set pressure relief at a lower pressure than would cause unsafe operation of any connected and properly adjusted gas utilization equipment.

][2.6.4 Overpressure Protection for Service Lines, Operating Pressure Greater than 414 kPa60 psig, but Less than 862 kPa125 psig

****

NOTE: Omit this paragraph where the service regulator specified above, para 2.4.2, contains internal pressure relief, a downstream relief valve, or downstream automatic shut-off; because the installation of any one of these devices complies with 192.197(c)(3).

49 CFR 192, Section 197(c) presents the minimum requirements for overpressure protection of customer piping and appliances that are connected to a distribution pipeline operated at greater than 414 kPa60 psig.

This UFGS paragraph offers the overpressure protection solutions allowed by 49 CFR 192.197(c).

The designer may design and specify the method and device used to create overpressure protection that complies with 49 CFR 192 or, the designer may include all of the methods allowed in 49 CFR 192 to allow the contractor to select a cost effective method. However, the designer must coordinate this decision with the authorized Distribution System Operator to ensure compliance with locally adopted requirements or standards.

****

Where the gas distribution system is operated at a pressure greater than 414 kPa60 psig, but less than 862 kPa125 psig, provide one of the following methods of overpressure protection for the service regulator and facility gas piping system:

a. Additional upstream regulator plus pressure relief or automatic shut-off.

b. Additional upstream monitoring regulator that, in the event of service regulator failure, prevents the pressure of gas supplied to the customer from exceeding a maximum safe value.

c. A service regulator with internal relief or downstream relief valve.

d. An automatic shut-off device with manual reset.

][2.6.5 Overpressure Protection for Service Lines, Operating Pressure Greater than 862 kPa125 psig

****

NOTE: Service regulators complying with ANSI B109.4 are limited to 862 kPa125 psig inlet pressure.

49 CFR 192, Section 197.(c)(3) further qualifies the minimum requirements for overpressure protection of service regulators connecting to a distribution pipeline operated at greater than 862 kPa125 psig. Section 197(c)(3) requires one of the overpressure protection solutions listed in the bracketed text of this specification paragraph.

Where the distribution system operates at a pressure, higher than 862 kPa125 psig, retain the following paragraph and select from the bracket text.

****

In addition to the required service regulator, provide an additional upstream [regulator that is set to maintain the inlet pressure to the

service regulator to 414 kPa60 psig or less] [monitoring regulator to limit the pressure of gas supplied to the facility gas piping to the lowest, maximum inlet pressure of any appliance regulator connected to the facility gas piping].

]2.7 METERS

****

NOTE: Meter selection must comply with the Advanced Metering Program being implemented at the specific Government Installation where work is being performed. The design engineer must contact the project Contracting Officer to determine the appropriate point of contact for this advanced metering program. The design engineer must then consult with the point of contact, approved by the Contracting Officer, to ensure that the specified natural gas metering system is compliant with the current requirements for the advanced metering program and the current, site applicable cybersecurity protection. Any metering selected must comply with the requirements of Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

The gas meters specified in this paragraph are qualified for natural gas, manufactured gas and LPG in its vapor phase. Designer must specify the maximum allowable operating pressure of the meter at no less than 10 psig per 49 CFR 192 and must protect the meter from over pressurization IAW 49 CFR 192.197.

****

Provide gas meters for [natural gas][manufactured gas][liquefied petroleum gas in the vapor phase] that comply with [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. Rate meters for a maximum allowable operating pressure of [69 kPa 10 psig][_____ psig] [Provide 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.

2.7.1 Utility Monitoring and Control System (UMCS) or Automatic Meter Reading Interfaces

Provide gas meters capable of interfacing the output signal, equivalent to volumetric flow rate, with the existing UMCS 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. Meters installed must comply with Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS. Meters installed must comply with Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

2.7.2 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 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.

2.9 GAS TRANSITION FITTINGS

Provide manufactured steel-to-plastic gas transition fittings approved for jointing steel and polyethylene pipe, conforming to ASTM F1973 requirements for transition fittings.

Provide anodeless riser on service lines to transition from below grade plastic piping to above grade steel piping in accordance with 49 CFR 192. Polyethylene-to-steel anodeless risers must comply with ASTM F1973 and ASTM D2513 - Category 1 specifications for gas tight seal and pull-out resistance. Protect steel pipe from corrosion by a factory applied coating.

2.10 IDENTIFICATION

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

2.11 ELECTRICALLY ISOLATED JOINT MATERIALS

Provide insulating joint materials between flanged or threaded metallic pipe systems to electrically isolate piping that is protected by cathodic protection systems. Devices must comply with NACE requirements.

[2.12 NATURAL GAS COMPRESSORS

****

NOTE: Delete this paragraph where natural gas compressors are not installed in the project.

The Designer of Record must coordinate all operating conditions with the gas compressor manufacturer and adhere to this manufacturer's advice on necessary appurtenance, materials, and installation practices for piping systems connected both upstream and downstream of this compressor.

Code information is limited for natural gas compression system design and installation. Therefore, compliance with API standards and recommended practices and commercially available information for the compressor is mandatory for the design and construction of systems intended to compress natural gas.

****

Provide natural gas compressors that comply with [API Std 617][API Std 618][API Std 619].

Provide all devices necessary for safe operation and environmental protection to include snubbers, valves, fittings and other appurtenances as shown on the design drawings.

]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 LPG CONTAINERS

Install LPG containers in accordance with NFPA 58 requirements for the type and volumetric capacity of the designed tank. Install each container with the required appurtenances as defined in NFPA 58. Mount each LPG tank on a concrete pad with anchor bolts or other tie down devices that provide resistance to tip over, caused by external forces defined in ASCE 7-16 and allow necessary movement to compensate for thermal expansion and contraction. Observe required separation distance from occupied buildings and building openings.

3.4 GAS MAINS

Provide steel pipe for aboveground installation. Provide polyethylene pipe for underground service..

[Where connection is made to an existing distribution pipeline constructed of Polyamide-11 pipe, construct new system using Polyamide-11 pipe or use approved connection fitting to connect new polyethylene pipe.]

[Where connection is made to an existing distribution pipeline constructed of Reinforced Epoxy Resin pipe, construct new system using Reinforced Epoxy Resin pipe or use approved connection fitting to connect new polyethylene pipe.]

3.5 SERVICE LINES

****

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, located in a valve box. 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.

3.6 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.

3.7 PROTECTIVE COATING

3.7.1 Protective Coating for Underground Steel Pipe

****

NOTE: If casings are installed on plastic pipe installed below grade, then retain this paragraph. Remove this paragraph where no steel pipe is to be installed below grade.

****

Where steel pipe is installed below grade for either the gas carrier pipe or as a casing for plastic carrier pipe, protect this pipe from corrosion by an extruded polyolefin resin coating system over a soft adhesive applied to the steel pipe. This coating must be either factory applied or

applied using a 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.

3.7.1.1 Field Plant Applied Polyolefin Resin Coating System

Provide a polyolefin resin 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 with a nominal thickness of 0.25 mm10 mils (plus or minus 10 percent). Immediately after the adhesive is applied, extrude a seamless tube of polyolefin over the adhesive to produce a bonded seamless coating, with a nominal thickness of 1.0 mm 40 mils (plus or minus 10 percent) of polyolefin resin for pipes up to 400 mm 16 inches in diameter. For pipes 450 mm 18 inches and larger in diameter, apply a minimum thickness of 1.5 mm 60 mils (plus or minus 10 percent) polyolefin resin.

3.7.1.2 Pipe Joint and Field Repair Coating System

Apply joint coating and field repair material as recommended by the coating manufacturer, consisting of one the following:

a. Heat shrinkable polyethylene sleeves.

b. High density polyethylene/bituminous rubber compound tape.

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

3.7.1.3 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.

3.7.2 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:

3.7.2.1 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.

3.7.2.2 Nonferrous Surfaces

****
NOTE: Retain only the first sentence for normal conditions. Delete the first sentence and retain the second sentence for corrosive conditions.
****

[Do not paint nonferrous surfaces.] [Paint nonferrous surfaces to protect from the exposed 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].]

3.7.3 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.

3.8 INSTALLATION

****
NOTE: When existing gas piping is abandoned, show disconnect details on the drawings. Refer to ASME B31.8 for guidance on preparing the disconnect details. ASME B31.8 requires physical disconnection from gas sources. Shutoff valves are not an acceptable means of disconnect. ASME B31.8 may be used as a reference, but the disconnection and abandonment must comply with the requirements of 49 CFR 192, Section 727.
****

Install gas distribution system and equipment in conformance with the manufacturer's recommendations and applicable sections of 49 CFR 192.

3.8.1 Abandonment of Natural Gas Distribution Pipelines

Perform abandonment of existing gas piping in accordance with ASME B31.8, the contract drawing details and the requirements of 49 CFR 192, Section 727. Purge natural gas piping so that there is no potential hazard. Provide locking devices for the shut-off valve located at the end of the service line supplying gas to a discontinued customer. 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. Fill abandoned vaults with suitable compacting material.[Record and submit to the COR the Geographic Information System (GIS) location of any abandoned distribution pipeline that crosses over, under, or through a navigable waterway.]

3.8.2 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 on the drawings and identified by Geospatial coordinates.

****

Grade gas mains and service lines as indicated. Grade service lines so as to drain back to the main or into drips 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 49 CFR 192. 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 and not encased in a metallic casing, place a tracer wire or other electrically conductive element above the pipe in accordance with 49 CFR 192 to permit locating with underground detection devices. After laying of pipe and testing, backfill the trench in accordance with Section 31 00 00 EARTHWORK, and in a manner provides firm support under the pipe and prevents damage to the pipe and pipe coating from equipment or from the backfill material.

3.8.3 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.

3.9 PIPE JOINTS

Provide pipe joints complying with the requirements of 49 CFR 192, Subpart E for welding of steel pipelines and Subpart F for joints other than welding. Design and install pipe joints to effectively sustain the longitudinal pullout forces and thrust forces caused by the contraction and expansion of piping or superimposed loads. Make each joint in accordance with the submitted and approved written joining procedure that has been proven to produce strong, gas-tight joints. Each joint must be

inspected by the approved inspector.

3.9.1 Threaded Steel Joints

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

3.9.2 Welded Steel Joints

Perform gas pipe weldments, as indicated, in accordance with the submitted and approved welding procedures, and by the approved qualified welders. 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, heat treatment, and inspection of welds conforming to API Std 1104 and the ASME Boiler and Pressure Vessel Code. 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..

3.9.3 Plastic Pipe Jointing Procedures

Use jointing procedures that have been submitted and approved for this project. Joints in plastic pipe must be made by the qualified personnel submitted and approved for this project, who have the requalification requirements of 49 CFR 192, Section 285. Each joint made must be inspected by the qualified inspector that was submitted and approved for this project.

Heat fusion joining of plastic pipe or fittings made from different plastic resins by classification or by manufacturer are not allowed. If heat fusion joining of similar polyethylene resin classification is required in pipe made by different manufacturers, the procedure must be qualified by test in accordance with 49 CFR 192, Section 283 requirements and AGA XR0603. The personnel making these joints must be qualified using this procedure in accordance with 49 CFR 192, Section 285 requirements. Submit all data: written procedure, test specimens, test results, inspection reports, etc. to show complete jointing qualification per 49 CFR 192 requirements to the COR.

Where joining procedures for plastic pipes by heat fusion cannot be properly qualified, an alternative connection method must be used.

3.9.4 Mechanical Couplings for Plastic Pipe Jointing

Make mechanical joints in accordance with the procedures that have been qualified in accordance with 49 CFR 192, Section 283(b). Submit evidence that the five specimen joints configured and tested in accordance with 283(b)(1), (2) and (3) failed in a manner consistent with 283(b)(4), (5) and (6) as applicable. For the mechanical coupling, obtain the manufacturer's model number, serial number, and date of manufacture, record the date of installation and obtain the Geographical Information

System (GIS) location of the installed mechanical coupling. Submit to the COR, this and all other data required by 49 CFR 192 to be submitted to the Pipeline and Hazardous Material Safety Administration (PHMSA).

3.9.5 Connections Between Metallic and Plastic Piping

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

3.10 VALVES

Install valves in locations shown on the drawings and at locations required by 49 CFR 192. 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.

For systems where the maximum distribution pressure exceeds 414 kPa60 psig operating pressure, provide a method to regulate and limit the pressure of the gas in the system that complies with 49 CFR 192.197 paragraphs (c)(1) through (4).

3.11 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 and install an access cover that is traffic rate cast iron of ample thickness to support expected traffic loads. 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 in valve boxes or inside of buildings.

3.12 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 distributing 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.

3.13 PRESSURE REGULATOR INSTALLATION

3.13.1 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.

3.13.2 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. Where steel service lines are used, 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.

3.14 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 49 CFR 192. 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. Connect meter complying with the requirements of the Advanced Metering Program that is applied at the particular Government Installation of this project.

3.15 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 49 CFR 192, 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.

3.15.1 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 a 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.

3.15.2 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 that is compliant with the requirements of 49 CFR 192, Section 727 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.

For each pipeline that is to be abandoned in place, submit the approved Connection and Abandonment Plan that is compliant with the requirements of 49 CFR 192, Section 727. Ensure the following steps are taken at a minimum:

a. For each pipeline that is to be abandoned in place, physically disconnect that from all sources of gas. Purge, cap, plug or otherwise effectively seal the open ends of all abandoned pipelines. Do not complete abandonment until it has been determined that the volume of gas or condensed 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 the disconnected end of the main and seal the customer's end of each service line as stipulated above.

c. Where service lines are to be abandoned in place, disconnect the abandoned service lines from the active mains as close to the main as practicable. 49 CFR 192 does not require individual service lines to be sealed.

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.

3.16 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 3-570-01. Provide testing stations for the cathodic protection system.

****

Provide cathodic protection in accordance with NACE SP0169 for all metallic gas piping installed underground and install as specified in

[Section 26 42 13 GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM] [Section 26 42 17 IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEM].

3.17 TESTS

3.17.1 Destructive Tests of Plastic Pipe Joints

****

NOTE: Destructive tests of plastic pipe joints are provided as a designer option. 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 heat fusion joints in plastic pipelines, 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. Make the specimen joint per the approved written procedure. 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. Deform each of the 3 straps 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 and submit 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.

3.17.2 Pressure and Leak Tests

****

NOTE: When selecting test pressure and test medium, observe the rules written in 49 CFR 192 Subpart J. The maximum test pressure and duration of pressure testing of plastic pipelines must be controlled in accordance with ASTM F2786 for pneumatic testing and ASTM F2164 for hydrostatic testing.

Specify correct test pressure (including Class Location) to be used for tests of gas line systems in accordance with 49 CFR 192 Subpart J. 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.

For LPG distribution pipelines, follow the requirements of 49 CFR 192 Subpart J, as NFPA 58 yields these testing requirements.

49 CFR 192, Section 505 details the method of determining strength test pressures for steel pipelines operating at a hoop stress of 30% or more

of the Specified Minimum Yield Strength (SMYS). The pressure necessary to achieve this hoop stress is higher than most distribution pipeline operating pressures. Remove the associated requirements where the pipeline is not operated at 30% of the SMYS.

49 CFR 192, Section 507 details leak test requirements for metallic mains operating at or above 689 kPa 100 psig.

49 CFR 192, Section 509 details leak test requirements for metallic mains operating below 689 kPa 100 psig.

49 CFR 192, Section 511 details leak test requirements for metallic service lines.

49 CFR 192, Section 513 details leak test requirements for plastic pipelines.

****

Test the system of gas mains and service lines after construction and before being placed in service, using a test pressure and test medium approved in 49 CFR 192 Subpart J for the applicable conditions of construction. In the event of conflict between the contract test pressure and medium and the test requirements of 49 CFR 192, refer conflict to the COR before continuing with testing. Follow all testing recommendations and safety precautions as recommended by the piping manufacturer's specifications and 49 CFR 192. Follow a written test procedure that ensures all potentially hazardous leaks are discovered. Submit data in booklet form from all pressure tests of the distribution system.

3.17.2.1 Test Pressure

Test each segment of the installed pipeline at the test pressure listed below for the applicable installation:

a. Strength test steel pipelines operated at a pressure that creates a hoop stress of 30% or more of the Specified Minimum Yield Strength (SMYS), in accordance with 49 CFR 192, Section 505, by hydrostatic testing at a minimum of 125 percent the Maximum Allowable Operating Pressure (MAOP). Maintain strength test pressure for a minimum of 8 hours.

b. For metallic mains operated at or above 689 kPa100 psig that produces a hoop stress less than 30 percent SMYS, leak test in accordance with 49 CFR 192, Section 507, by [pneumatic][hydrostatic] testing at a pressure between 689 kPa100 psig and the pressure required to produce a hoop stress of 20 percent of the SMYS. Maintain test pressure for a minimum of 24 hours.

c. For metallic mains operated below 689 kPa100 psig, leak test in accordance with 49 CFR 192, Section 509. Leak test mains operated below 6.9 kPa1 psig to a pressure not less than 69 kPa10 psig. Leak test mains operated at or above 6.9 kPa1 psig to a pressure not less than 621 kPa90 psig. Maintain test pressure for a minimum of 24 hours.

d. For metallic service lines, leak test in accordance with 49 CFR 192, Section 511. Leak test service lines operated at 276 kPa40 psig or

less to a pressure not less than 345 kPa50 psig. Leak test service lines operated above 276 kPa40 psig to a pressure of 621 kPa90 psig. Ensure that the service line connection to the main is included in this test. Maintain test pressure for a minimum of 24 hours.

e. For plastic mains and service lines, leak test in accordance with 49 CFR 192, Section 513. Leak test to a pressure at least 150% of the Maximum Allowable Operating Pressure (MAOP) or 345 kPa50 psig, whichever is greater. Where a compressible gas is used as the test medium, perform pneumatic leak testing of polyethylene (PE) piping in accordance with ASTM F2786 observing the determination of Maximum Test Pressure, which is calculated using the PE material hydrostatic design stress, the pipe temperature reduction factor and the leak test duration factor. Submit a test procedure that identifies the MAOP of the pipeline, the temperature dependent maximum test pressure, and a step by step procedure for increasing the pipeline pressure as detailed in ASTM F2786 for pneumatic testing or ASTM F2164 for hydrostatic testing. From the beginning of pipeline pressurization to the depressurization of the pipeline the time duration must not exceed 8 hours. If testing must be restarted after maximum test pressure has been reached, depressurize the pipeline for a minimum of 8 hours before restart of pipeline pressurization.

3.17.2.2 Test Performance

Perform testing as follows:

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 during testing. 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 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.

3.17.3 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.

3.18 NATURAL GAS COMPRESSORS

Natural gas compressors must be installed in accordance with all manufacturer's procedures and recommendation. Installations must comply with the design drawings and API RP 686.

3.19 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.

3.19.1 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.

3.19.2 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.

3.19.3 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 --