
USACE / NAVFAC / AFCEA UFGS-02551N (August 2001)

Preparing Activity: NAVFAC Superseding
UFGS-02551N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Latest change indicated by CHG tags

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02551N

NATURAL GAS DISTRIBUTION

08/01

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 RELATED REQUIREMENTS
- 1.3 SYSTEM DISTRIBUTION
 - 1.3.1 Gas Distribution System and Equipment Operation Data
 - 1.3.2 Gas Distribution System Maintenance Data
 - 1.3.3 Gas Distribution Equipment Maintenance Data
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - 1.6.1 Delivery and Storage
 - 1.6.2 Handling

PART 2 PRODUCTS

- 2.1 PIPING MATERIALS FOR GAS DISTRIBUTION MAINS
 - 2.1.1 Steel Pipe and Fittings
 - 2.1.1.1 Joints and Jointing Materials
 - 2.1.1.2 Welded Joints
 - 2.1.1.3 Flanged Joints
 - 2.1.1.4 Insulating Joints
 - 2.1.1.5 Shop-Applied Coatings for Buried Steel Pipe and Fittings
 - 2.1.1.6 Coal Tar Enamel Coating
 - 2.1.1.7 Adhesive-Thermoplastic Resin Coating
 - 2.1.1.8 Fusion-Bonded Epoxy Coating
 - 2.1.1.9 Field-Applied Corrosion Protection Materials
 - 2.1.2 Plastic Pipe, Fittings, Joints, and Jointing Materials
 - 2.1.2.1 Reinforced Thermosetting Epoxy Resin (RTR)
 - 2.1.2.2 Thermoplastic (Polyethylene - PE)
 - 2.1.3 Mechanical Crimp-Type Fittings for PE Pipe
- 2.2 PIPING MATERIALS FOR GAS SERVICE LINES
 - 2.2.1 Steel Pipe, Fittings, Joints and Jointing Materials
 - 2.2.2 PE Pipe and Heat Fusion Fittings

- 2.3 GAS MAIN VALVES AND ACCESSORIES
 - 2.3.1 Shut-Off Valves
 - 2.3.1.1 Plug Valves
 - 2.3.1.2 Ball Valves
 - 2.3.1.3 Below Ground Polyethylene Valves
 - 2.3.2 Gas Main Regulator Station
 - 2.3.2.1 Regulator Valve
 - 2.3.2.2 Pressure Relief Valve
 - 2.3.2.3 Strainer
 - 2.3.3 Valve Boxes
 - 2.3.4 Drips
- 2.4 GAS SERVICE LINE VALVES AND ACCESSORIES
 - 2.4.1 Valves
 - 2.4.2 Valve Boxes for Curb Cocks
- 2.5 CASING PIPE

PART 3 EXECUTION

- 3.1 LOCATION OF GAS LINES
- 3.2 VERIFICATION OF CONDITIONS
- 3.3 INSTALLATION OF PIPELINES
 - 3.3.1 Pipe Laying and Jointing
 - 3.3.2 Buried Warning and Identification Tape
 - 3.3.3 Connections to Existing Pipelines
 - 3.3.4 Installation Beneath Railroad Right-of-Way
 - 3.3.5 Installation of Valves for Gas Mains
 - 3.3.6 Special Requirements for Steel Gas Main Piping Installation
 - 3.3.6.1 Earthwork for Steel Gas Main Piping
 - 3.3.6.2 Steel Gas Main Piping Joints
 - 3.3.7 Special Requirements for [RTR] [PE] Gas Main Piping Installation
 - 3.3.7.1 Placement
 - 3.3.7.2 Earthwork for Plastic Gas Main Piping
 - 3.3.7.3 Plastic Gas Main Piping Joints
 - 3.3.8 Special Requirements for Gas Service Piping Installation
 - 3.3.8.1 Earthwork for Gas Service Piping
 - 3.3.8.2 Service Connections
 - 3.3.8.3 Gas Service Piping Joints
 - 3.3.8.4 Valve Installation on PE Service Lines
- 3.4 PROTECTION AGAINST CORROSION (FIELD APPLIED)
 - 3.4.1 Corrosion Protection Systems
 - 3.4.2 Application of Plastic Tape
 - 3.4.3 Coal Tar Base Coating
 - 3.4.4 Painting
 - 3.4.5 Installation of Insulating Fittings
- 3.5 ABANDONED GAS LINES
 - 3.5.1 Lines Abandoned in Place
 - 3.5.1.1 Service Lines
 - 3.5.1.2 Above-Grade Valves, Risers, and Vaults and Valve Boxes
 - 3.5.2 Lines Abandoned and Removed
- 3.6 FIELD QUALITY CONTROL
 - 3.6.1 Inspection of Welds
 - 3.6.2 Testing of Pipe Coatings
 - 3.6.3 Piping Strength and Tightness Tests
- 3.7 PURGING LINES
- 3.8 FINAL CLEAN-UP

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA UFGS-02551N (August 2001)

Preparing Activity: NAVFAC Superseding
UFGS-02551N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Latest change indicated by CHG tags

SECTION 02551N

NATURAL GAS DISTRIBUTION 08/01

NOTE: This guide specification covers the requirements for natural gas distribution main and service line piping systems to be operated at low pressure or at high pressure.

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

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

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: A low pressure system is one in which the pressure is substantially the same as the pressure provided to the customer. A high pressure system is one in which the pressure is higher than the standard service pressure delivered to the customer, but not in excess of 413 kPa (gage) 60 psig. If a gas distribution system is required to operate at pressures higher than 413 kPa (gage) 60 psig, the various pipe, fitting, and valve specifications used herein must be reviewed to determine their applicability to the higher pressures, additional pressure regulators and pressure limiting devices must be installed as required in ASME B31.8, and the appropriate paragraphs modified as necessary. Initial test pressure for systems that will operate at pressures higher than 413 kPa (gage) 60 psig shall be a minimum of 1.5 times the maximum working

pressure.

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

1. Plan and location of all new pipelines, including size of pipe.
2. Maximum working pressure of the system.
3. Location, size, and type of service of existing connecting, intersecting, or adjacent pipelines and other utilities.
4. Paved areas and railroads which pass over new pipelines.
5. Profile, where necessary, to show unusual conditions.
6. Type or wall thickness of pipe, including material identification, and limits for same where type or wall pipeline.
7. Location of flanged joints, screwed joints, and insulating joints, unless location is covered in the project specification.
8. Location of valves including necessary details.
9. Location, size, type, and details of low point condensate drips.
10. Details of valve installation on RTR and PE pipelines.
11. Details of regulator station, including location of all items therein, capacity, pressure reduction and size; if an underground vault is used the vault shall conform to ASME B31.8.
12. Connection of service line to gas main.
13. Bedding conditions, where different from those specified.
14. Location, type and size of pipe anchors, when required for the project.

NOTE: Allowable Piping Materials:

1. The project specification should allow all piping materials for gas mains and for gas service lines which are included in this guide, each to be permitted as a Contractor's option. The material and

construction specifications should be representative of suitable practice for the geographic location and service intended. It is intended however, that steel pipe only be used for gas mains and services wherever external loading conditions for the pipe exceed the normal; i.e., corrosion, road, and railroad crossings. In the event that unusual conditions affect only a part of the gas line, that part should be steel.

2. Pipe materials which are known to be unsuitable for particular local conditions (i.e., corrosion, deterioration) should not be permitted for the project. However, consideration should be given to the use of more effective protective coatings where economically feasible.

3. When RTR or PE pipe or tubing is specified for use in gas distribution piping, detailed investigation should be made for assurance that the material selected for use is suitable for the service intended. Areas of investigation should include: excessive external loading as a result of heavily traveled roads, storage areas, ambient temperature range, use of manufactured or mixed gases, introduction of antifreeze solution and so forth. PE pipe and fittings should not be allowed for any project where the gas distributed is liquid petroleum manufactured gas, or a mixture of manufactured and natural gas.

4. Ductile-iron, RTR or PE and plastic pipe should not be allowed if the project is located in an area subject to seismic forces, erosion, or unstable soils.

5. PE may be allowed for direct buried exterior gas distribution mains and service lines only if recommended by the local gas utility.

NOTE: Pipe Design:

1. Equivalent pipe design for the project conditions (using the applicable criteria for each pipe material) should be specified for each pipe material insofar as is practicable, in view of the fact that design criteria differ for the standard manufactured pipe of the different materials.

2. External loads, including earth loads, truck loads, seismic loads, and impact, should be investigated in the design stage of the project.

3. Where different classes, wall thicknesses, etc., of pipe are required for different sections of pipelines due to significant differences in external loading, the applicable paragraphs for the project

specification should be expanded or modified accordingly. The limits for each class, wall thickness, or pressure rating, should be either shown on the project drawings or appropriately described in the applicable paragraph of the project specification.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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 PETROLEUM INSTITUTE (API)

API Spec 5L	(2000) Line Pipe
API Spec 6D	(2002) Specification for Pipeline Valves
API Std 1104	(1999; E 2001) Welding of Pipeline and Related Facilities

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C203	(2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C213	(2001) Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

ASME INTERNATIONAL (ASME)

ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.40	(2002) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.8	(2000) Gas Transmission and Distribution

Piping Systems

ASME PTC 25.3

(1988) Safety and Relief Valves

ASTM INTERNATIONAL (ASTM)

ASTM A 135

(2001) Electric-Resistance-Welded Steel Pipe

ASTM A 139

(2000) Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

ASTM A 53

(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM D 1598

(2002) Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

ASTM D 1599

(1999) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings

ASTM D 2513

(2003a) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2517

(2000e1) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

ASTM D 2774

(2001) Underground Installation of Thermoplastic Pressure Piping

ASTM D 3839

(2002) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

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

MSS SP-110

(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MSS SP-72

(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service

MSS SP-78

(1998) Cast Iron Plug Valves, Flanged and Threaded Ends

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3

(1982; R 2000) Power Tool Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-C-18480

(Rev B; Notice 1) Coating Compound, Bituminous, Solvent, Coal-Tar Base

MIL-T-27730

(Rev A; Notice 2) Tape, Antiseize, Tetrafluoroethylene, with Dispenser

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS L-C-530 (Rev C) Coating, Pipe, Thermoplastic Resin

FS L-T-1512 (Rev A) Tape, Pressure Sensitive Adhesive,
Pipe Wrapping

1.2 RELATED REQUIREMENTS

Section 15050N BASIC MECHANICAL MATERIALS AND METHODS, applies to this section unless otherwise specified.

1.3 SYSTEM DISTRIBUTION

The gas distribution system includes natural gas piping and appurtenances from point of connection with existing system as indicated to a point approximately 1500 mm 5 feet from the buildings.

1.3.1 Gas Distribution System and Equipment Operation Data

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).

1.3.2 Gas Distribution System Maintenance Data

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.

1.3.3 Gas Distribution Equipment Maintenance Data

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.

1.4 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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

Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

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

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping

Fittings

Valves

Pipe coatings

SD-07 Certificates

Welders procedures and qualifications (metal and PE)

Pipe coating materials and application procedures

SD-10 Operation and Maintenance Data

Gas distribution system and equipment operation, Data package 4; G

Gas distribution system maintenance, Data package 4; G

Gas distribution equipment maintenance, Data Package 3; G

Submit operation and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA, in three separate packages.

1.5 QUALITY ASSURANCE

Materials and equipment shall conform to ASME B31.8 to the extent specified herein, to local utility requirements, and to other requirements specified.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 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.

1.6.2 Handling

Handle pipe, fittings, valves, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Take special care not to damage coatings on pipe and fittings. Repair damaged coatings to original finish. Handle steel piping with coal-tar enamel coating in accordance with AWWA C203.

PART 2 PRODUCTS

2.1 PIPING MATERIALS FOR GAS DISTRIBUTION MAINS

Piping shall be [black steel,] [reinforced thermosetting epoxy resin (RTR)] [or] [polyethylene (PE)]. Provide shutoff valves [and insulating joints] where indicated.

2.1.1 Steel Pipe and Fittings

NOTE: Delete all words in brackets when steel pipe is expected to be subjected to unusually severe conditions (including handling) such as impact stresses, seismic forces, burial beneath vehicle or railroad crossings, significant differential settlement, or underneath piers.

API Spec 5L, Grade [A,] B, or X42, [ASTM A 53, Grade A or B, ASTM A 135, or ASTM A 139, Grade A or B], Schedule 40. Coat pipe and fittings for underground lines as specified in paragraph entitled "Shop-Applied Coatings for Buried Steel Pipe and Fittings." Do not coat pipe and fittings for aboveground lines. Butt weld fittings shall be wrought steel, ASME B16.9, Schedule 40. Socket weld and threaded fittings shall be forged steel, ASME B16.11.

2.1.1.1 Joints and Jointing Materials

NOTE: Welded joints are preferred when using steel pipe. Flanges and screwed joints are not recommended for use on buried pipe. Steel flanges should not be connected to cast-iron flanges on buried pipelines in any case.

Pipe and fittings shall have welded joints [except as otherwise indicated or specified]. [Provide [flanged] [or] [threaded] joints where indicated.] [Provide insulating joints where indicated.]

2.1.1.1.2 Welded Joints

Electrodes, joint design, welders procedures and qualifications (metal and PE), and weld examination and testing shall conform to API Std 1104.

2.1.1.1.3 Flanged Joints

Steel flanges shall conform to ASME B16.5, Class 150. Steel flanges that are to be connected to cast iron flanges shall be flat face construction. Provide raised face steel flanges for pipe-to-pipe connections and connections to flanged steel valves. Bolts, nuts, and gaskets shall conform to ASME B31.8.

2.1.1.1.4 Insulating Joints

[Insulating flanged joints shall be steel flanges as specified in paragraph entitled "Flanged Joints," double end stud bolts sized 1.60 mm 1/16 inch smaller than standard flange bolt holes, heavy hex nuts, a neoprene faced insulating gasket, a 0.80 mm 1/32 inch plastic sleeve covering each stud bolt, and a plastic insulating washer between the flange and each hex nut on one side of the fitting.] [Insulating unions shall be steel, rated at 1724 kPa (gage) 250 psi working pressure and 93 degrees C 200 degrees F temperature. Insulation between union parts shall withstand a minimum of 600 volts.]

2.1.1.1.5 Shop-Applied Coatings for Buried Steel Pipe and Fittings

Pipe coating materials and application procedures on a properly prepared surface shall be as specified in ASME B31.8. Coating shall have sufficient adhesion to the metal surface to prevent underfilm migration of moisture, and be sufficiently ductile to prevent cracking. Coating shall have strength to prevent damage due to handling and soil stress, and have properties compatible with supplemental cathodic protection. Pipe shall receive either coal tar enamel, adhesive-thermoplastic resin, or fusion-bonded epoxy, shop-applied coatings. Completed joints shall be coated after installation and testing as specified in paragraph entitled "Protection Against Corrosion (Field Applied)."

2.1.1.1.6 Coal Tar Enamel Coating

NOTE: For all ordinary purposes, single wrapping of pipe is considered to afford sufficient protection. Where additional shielding is necessary because of stony soil or as additional protection in shipping, double wrapping should be specified.

Except as otherwise specified in this paragraph, clean, prime, and coat exterior of pipe and fittings with hot-applied coal tar enamel and [a bonded layer of felt wrap in accordance with AWWA C203] [bonded double felt wraps in accordance with AWWA C203, and Appendix Section A1.2 of AWWA C203]. Do not use asbestos felt. Provide fibrous-glass mat felt material as specified in Appendix Section A2.1 of AWWA C203. Coating shall be

shop-applied and have a minimum thickness of 3.00 mm 120 mils.

2.1.1.7 Adhesive-Thermoplastic Resin Coating

Exterior of pipe and fittings shall be cleaned and receive a factory applied continuously extruded polyethylene coating with an adhesive undercoat beneath the polyethylene coating. Coating system shall conform to FS L-C-530. Coating thickness for pipe 114.60 mm 4.51 inches od and larger shall be 0.90 mm 36 mils minimum. Coating thickness for pipe smaller than 150 mm 6 inches shall be as specified in FS L-C-530. Polyethylene coating shall be cut back 102 mm 4 inches on each end.

2.1.1.8 Fusion-Bonded Epoxy Coating

Exterior of pipe and fittings shall be cleaned and receive a factory applied coating of fusion-bonded epoxy resin. Coating material shall be sprayed on the heated pipe in a powder form. Epoxy coating system for steel pipe shall conform to AWWA C213. Joints may be field epoxy coated as specified in AWWA C213, or coated as specified in paragraph entitled "Protection Against Corrosion (Field Applied)."

2.1.1.9 Field-Applied Corrosion Protection Materials

- a. Plastic Tape Material: Conform to FS L-T-1512, Type I, 0.25 mm 10 mils nominal thickness for pipe joints and Type II, 0.50 mm 20 mils nominal thickness for repairing damaged areas of shop-applied coatings.
- b. Coal Tar Base Coating: MIL-C-18480. Apply on flanges and other irregular surfaces to a minimum dry-film thickness of 0.75 mm 30 mils.

2.1.2 Plastic Pipe, Fittings, Joints, and Jointing Materials

2.1.2.1 Reinforced Thermosetting Epoxy Resin (RTR)

RTR plastic pipe and fittings shall conform to ASTM D 2517 and have adhesive joints. Adhesively join flanges to pipe at connections to [valves] [metal accessories] [and] [metal pipe]. Adhesive for jointing shall be in accordance with ASTM D 2517.

2.1.2.2 Thermoplastic (Polyethylene - PE)

PE pipe and heat fusion fittings shall conform to ASTM D 2513, Grade PE2406 or PE3408, SDR [____]. Pipe and fittings shall have heat fusion joints, except that approved mechanical crimp-type fittings conforming to paragraph entitled "Mechanical Crimp-Type Fittings for PE Pipe," may be used for 9.50 mm 3/8 inch od to 50 mm 2 inch IPS sizes. PE pipe and fitting materials for heat fusion shall be compatible to ensure uniform melting and a proper bond.

2.1.3 Mechanical Crimp-Type Fittings for PE Pipe

Provide axial crimp-type mechanical fittings for 9.50 mm 3/8 inchod through 50 mm 2 inch IPS PE tubing and pipe in gas piping systems. Fittings shall have plastic bodies with molded-in-place internal metal sleeves to fit the inside diameter of the pipe and shall be assembled on the pipe with nonremovable stainless steel axial crimping sleeves furnished as part of the fitting. Tensile strength of fittings and fitting pull-out strength

shall exceed that of the pipe on which installed. Fittings shall have passed sustained pressure tests at 379 kPa (gage) 200 psig and burst pressure tests at 2758 kPa (gage) 400 psig conforming to ASTM D 1598 and ASTM D 1599 test methods respectively.

2.2 PIPING MATERIALS FOR GAS SERVICE LINES

2.2.1 Steel Pipe, Fittings, Joints and Jointing Materials

NOTE: When gas main piping paragraphs are not included in the job, include the applicable information from those paragraphs in this paragraph and the paragraph below entitled "PE Pipe and Heat Fusion Fittings."

As specified for steel pipe for gas distribution mains. Threaded fittings shall be black malleable iron or steel. Do not install close nipples and unions underground. Pipe and fittings shall have welded joints [except as otherwise indicated or specified]. [Do not use threaded joints [except where indicated].] Pipe shall receive one of the shop-applied coatings specified in paragraph entitled "Shop-Applied Coatings for Buried Steel Pipe and Fittings."

2.2.2 PE Pipe and Heat Fusion Fittings

Conform to ASTM D 2513. Minimum wall thickness shall be as specified in ASTM D 2513. PE pipe and fittings shall have joints as specified for gas distribution main piping.

2.3 GAS MAIN VALVES AND ACCESSORIES

NOTE: When valves are to be installed in RTR or PE pipe or tubing, the project drawings shall include a detail showing the anchors to be installed and the technique to be used to ensure that no turning torque is imposed on the pipe.

2.3.1 Shut-Off Valves

Manually operated shut-off valves for gas distribution main and regulator station piping with a minimum pressure rating of 1034 kPa (gage) 150 psig.

2.3.1.1 Plug Valves

NOTE: Use reduced bore (65 percent area minimum) valves when resultant pressure drop is permissible; otherwise, use full bore (95 percent area) valves.

[API Spec 6D for steel valves] [or] [MSS SP-78 for cast iron valves]. Valves shall be [full bore] [reduced bore] type. Minimum bore size for [full bore] [reduced bore] valves shall be [95] [65] percent of the internal cross sectional area of pipe of the same nominal diameter. Steel valves installed on buried steel piping shall have butt-welding ends. Steel

valves installed on buried [RTR] [PE] piping shall have mechanical joint ends [except where flanged ends are indicated]. [Cast iron valves installed on buried [steel] [RTR] [PE] piping shall have mechanical joint ends [except where flanged ends are indicated].] [Valves not on buried piping shall have ends as indicated.] Plug valves shall be lubricated. Lubricating fittings on installed valves shall be accessible for relubrication, or extensions shall be provided to make them accessible. Plug valves shall be wrench or gear operated. [Wrench operated valves shall have a 50 mm 2 inch square adaptor securely fastened to the valve stem.] Maximum allowable operating torque in Newton-meter foot-pounds shall be limited to:

Nominal Valve Size (mm)	Torque (Newton-meter)
[20] [25] [40] [50]	[34.00]
[80] [100]	[47.60]
[150] [200] [300]	[95.20]

Nominal Valve Size (Inches)	Torque (Foot-Pounds)
[3/4] [1] [1-1/2] [2]	[25]
[3] [4]	[35]
[6] [8] [12]	[70]

2.3.1.2 Ball Valves

NOTE: Use reduced bore (65 percent area minimum)
valves when resultant pressure drop is permissible;
otherwise, use full bore (95 percent area) valves.

API Spec 6D or MSS SP-72 or MSS SP-110. Provide valve body material of carbon steel for installation on steel pipe, and ductile iron for installation on plastic pipe. Valves installed on buried steel piping shall have butt welding ends. Valves with welded ends shall be designed to permit replacement of seats and seals without removing the valve body from the line. Valves shall be [full bore] [reduced bore] type. Minimum bore size for [full bore] [reduced bore] valves shall be [95] [65] percent of the internal cross sectional area of pipe of the same nominal diameter. Valves used on buried [RTR] [PE] mains shall have mechanical joint ends [except where flanged ends are indicated]. [Valves not on buried piping shall have ends as indicated]. Ball valves shall be wrench or gear operated. [Wrench operated valves shall have a 50 mm 2 inch square adaptor securely fastened to the valve stem.] Maximum allowable operating torque in Newton-meter foot-pounds shall be limited to:

Nominal Valve Size (mm)	Torque (Newton-meter)
[20] [25] [40] [50]	[34.00]
[80] [100]	[47.60]
[150]	[68.00]
[200] [300]	[95.20]

Nominal Valve Size (Inches)	Torque (Foot-Pounds)
[3/4] [1] [1-1/2] [2]	[25]
[3] [4]	[35]
[6]	[50]
[8] [12]	[70]

2.3.1.3 Below Ground Polyethylene Valves

ASME B16.40. Provide PE valves only with underground PE piping.

2.3.2 Gas Main Regulator Station

NOTE: Pressure regulators are necessary at all points where design requires reduction in or regulation of pressure. When gas pressure regulators are required for a specific project, all necessary equipment should comply with the requirements of the local gas company and this paragraph should be so revised as necessary. A detail of each regulator installation should be shown on the drawings and the following data should be provided for each regulator: flow rate, type and specific gravity of the gas inlet and outlet pressures, accuracy of control and size of connections.

Includes regulator valve, relief valve, strainer, regulator by-pass piping, and plug or ball type shut-off valves as indicated. Regulator station piping and piping from buried gas lines to the regulator station shall be steel piping as specified for gas distribution main piping. Regulator station piping, fittings and valves shall be welded joint [except where [flanged] [and] [threaded] joints are indicated]. Pipe and equipment supports shall be of non-combustible material. Regulator station shall be located [in an underground vault] [aboveground] as indicated.

2.3.2.1 Regulator Valve

Steel or ductile-iron body, flanged ends for sizes 65 mm 2 1/2 inches and larger and threaded ends for sizes 50 mm 2 inches and smaller. Regulator valve shall conform to indicated size, capacity, and reduction of indicated pressure requirements. Provide overpressure protection to prevent gas pressure from exceeding the indicated value in accordance with ASME B31.8.

2.3.2.2 Pressure Relief Valve

NOTE: Delete the bracketed portion of this paragraph which is not applicable to the gas pressure of the system being designed. See the first note of this section for the definition of system pressure class.

Provide to prevent gas pressure from exceeding the indicated value, have

sufficient capacity to prevent overpressuring the system, and be adjusted to ensure that [a pressure increase shall not cause unsafe operation of connected and properly adjusted gas utilization equipment in a low-pressure distribution system] [maximum pressure shall not exceed maximum allowable operating pressure plus 41 kPa (gage) 6 psig in a high pressure system]. Each pressure relief valve shall meet the performance standards set forth in ASME PTC 25.3, and shall be steel or cast iron.

2.3.2.3 Strainer

Provide to remove particulate matter from the gas stream and have a steel or cast iron housing with a removable stainless steel strainer basket with a mesh sized to remove particles that would interfere with regulator valve operation.

2.3.3 Valve Boxes

Provide each valve on buried piping with a plastic or cast-iron valve box of a size suitable for the valve. Valve box shall have a round cover with the word "Gas" cast on it. Valve boxes shall be provided with lock-type covers that require a special wrench for removing. Each cast-iron box shall be given a heavy coat of bituminous paint.

2.3.4 Drips

Install at low points where indicated. Conform to details indicated or provide commercial units of the same capacity and type as those indicated.

2.4 GAS SERVICE LINE VALVES AND ACCESSORIES

NOTE: When gas main valve paragraphs are not
included in the job, include the applicable
information from those paragraphs in this paragraph.

NOTE: When valves are to be installed in RTR or PE
pipe or tubing, the project drawings shall include a
detail showing the anchors to be installed and the
technique to be used to ensure that no turning
torque is imposed on the pipe.

2.4.1 Valves

Provide plug or ball valves for service lines as specified for gas main valves.

2.4.2 Valve Boxes for Curb Cocks

Provide each valve on buried piping with a valve box as specified for gas main valves.

2.5 CASING PIPE

ASTM A 53, Grade A, Schedule [20] [30] [40] [60]. Coat as specified in paragraph entitled "Shop-Applied Coatings for Buried Steel Pipe and Fittings."

PART 3 EXECUTION

3.1 LOCATION OF GAS LINES

NOTE: Where appropriate (under a subparagraph to be entitled "Pipe Anchorage"), special requirements such as use of concrete coating to provide negative buoyancy in areas of flooding or tie rods attached to anchors in areas of erosion or unstable soils, should be written into the specifications for the project.

Do not install gas piping in the same trench with other utilities. The minimum horizontal clearance between gas pipe and parallel utility pipe shall be 610 mm 2 feet. Do not install gas pipe through catch basins, vaults, manholes or similar underground structures.

3.2 VERIFICATION OF CONDITIONS

Pipe, fittings, valves and accessories will be carefully inspected by the Contracting Officer or the Contracting Officer's authorized representative before and after installation and those found defective will be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition.

3.3 INSTALLATION OF PIPELINES

3.3.1 Pipe Laying and Jointing

Provide proper facilities for lowering sections of pipe into trenches. Cut pipe accurately to measurements established at the site and work into place without springing or forcing. Replace pipe or fittings that do not allow sufficient space for proper installation of jointing material with pipe or fittings of proper dimensions. Grade pipe in straight lines, taking care to avoid the formation of dips and low points. Support pipe at proper elevation and grade, taking care to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and all fittings shall rest solidly on the pipe bed, with recesses excavated to accommodate joints and couplings. Provide anchors and supports where indicated. Make provision for the expansion and contraction of pipe lines as indicated. Keep trenches free of water until joints have been made. Close open ends of pipe temporarily with wood blocks or plastic end closures at the end of each work day. Gas mains shall have a minimum earth cover of 760 mm 30 inches, except that in rock excavation, minimum earth cover shall be 610 mm 24 inches.

3.3.2 Buried Warning and Identification Tape

Provide color, type and depth of tape as specified in paragraphs "Buried Warning and Identification Tape" in Section 02300 EXCAVATION.

3.3.3 Connections to Existing Pipelines

When it is necessary to make connections to live gas mains, use pressure tight installation equipment. Connections shall be made in accordance with

ASME B31.8.

3.3.4 Installation Beneath Railroad Right-of-Way

Where pipeline passes under the right-of-way of a commercial railroad, installation shall be in accordance with recommendations of the railroad.

3.3.5 Installation of Valves for Gas Mains

NOTE: When valves are to be installed in RTR or PE pipe or tubing, the project drawings shall include a detail showing the anchors to be installed and the technique to be used to ensure that no turning torque is imposed on the pipe.

Install valves in accordance with applicable installation requirements specified in ASME B31.8 and as indicated. Install valve stems on buried piping vertically with a minimum of 200 mm 8 inches clearance from stem top to finished grade. Valves installed in [RTR] [PE] piping shall be restrained as indicated so that no turning torque is transmitted to the pipe.

3.3.6 Special Requirements for Steel Gas Main Piping Installation

Install pipelines as specified herein and in accordance with the applicable requirements of ASME B31.8.

3.3.6.1 Earthwork for Steel Gas Main Piping

Earthwork shall be in accordance with Section 02300 EXCAVATION. Employ hand excavation within 1500 mm 5 feet of existing gas pipelines or other underground structures. Do not damage pipe coating during earthwork operations.

3.3.6.2 Steel Gas Main Piping Joints

Weld joints unless otherwise [specified] [or] [indicated]. Make welded joints in accordance with ASME B31.8 and API Std 1104. Welders qualifications, welding procedures and weld examinations shall be in accordance with API Std 1104. Insulating joints installed underground shall be accessible. [Make flanged joints up tight, taking care to avoid undue strain on valves, fittings, and other accessories. Align bolt holes for each flanged joint. Install full-size bolts for bolt holes; installation of undersized bolts to make up for misalignment of bolt holes or for other purposes will not be permitted. Adjoining flange faces shall not be out of parallel to such degree that flanged joint cannot be made gas-tight without overstraining the flange. Faces of flanges and bolt and nut bearing areas shall be clean and smooth. Replace flanged pipe or fittings whose dimensions do not allow for making a proper flanged joint as specified herein with one of proper dimensions.] [Make up joints between ferrous and nonferrous metallic piping with insulating fittings.] [Threaded joints shall have tapered threads, evenly cut, and be made with Underwriter's Laboratories approved graphite compound for gas service or with polytetrafluoroethylene tape conforming to MIL-T-27730, applied to the male threads only. After cutting and before threading, ream pipe and remove burrs. Calking of threaded joints to stop or prevent leaks will not be permitted.]

3.3.7 Special Requirements for [RTR] [PE] Gas Main Piping Installation

NOTE: When RTR only is used, delete ASTM D 2774.
When PE only is used, delete ASTM D 3839.

Install pipelines as specified herein and in accordance with the applicable requirements of ASME B31.8 and [ASTM D 2774] [ASTM D 3839].

3.3.7.1 Placement

Maintain a minimum of 305 mm 12 inches clearance between [RTR] [PE] pipe and heating system piping. Install a No. 10 gage copper tracer wire with buried [RTR] [PE] pipe to facilitate location with an electronic detector. Install wire 205 to 305 mm 8 to 12 inches above pipeline and terminate 76 to 102 mm 3 to 4 inches above grade. Do not wrap wire around pipe.

3.3.7.2 Earthwork for Plastic Gas Main Piping

NOTE: When RTR only is used, delete ASTM D 2774.
When PE only is used, delete ASTM D 3839.

Earthwork shall be in accordance Section 02300 EXCAVATION and [ASTM D 2774] [ASTM D 3839]. Where practicable, plastic pipe and tubing shall be under an internal pressure of 103 kPa (gage) 15 psig during backfill operations. Employ hand excavation within 1500 mm 5 feet of existing gas pipelines or other underground structures.

3.3.7.3 Plastic Gas Main Piping Joints

NOTE: When RTR or PE pipe is required for the project and adhesive or heat fusion joints are to be made at temperatures less than 10 degrees C 50 degrees F, reference should be made to the specifications and techniques recommended by the manufacturer of the pipe and fittings for low temperature installation. The manufacturer's specifications should be incorporated as part of the detailed project specifications.

Make joints for [RTR] [PE] pipe or tubing and fittings in accordance with ASME B31.8 and the recommendations of the manufacturer of the pipe or tubing and fittings.

3.3.8 Special Requirements for Gas Service Piping Installation

Work shall include the connection to the building piping where the building piping has been installed. Where building piping has not been installed, terminate service lines with a temporary cap approximately 1500 mm five feet from the building line at a point directed by the Contracting Officer or the Contracting Officer's authorized representative. Installation shall be in accordance with the applicable requirements of ASME B31.8.
[Installation of PE pipe or tubing shall further be in accordance with the

applicable requirements of ASTM D 2774.] Minimum earth cover for service lines shall be 610 mm 24 inches in streets or roads and 305 mm 12 inches in private property. Install an electrically conductive No. 10 gage wire with buried PE pipe or tubing to facilitate location with an electronic detector. Install wire 150 to 205 mm 6 to 8 inches above service line and terminate 76 to 102 mm 3 to 4 inches above grade. Do not wrap wire around pipe.

3.3.8.1 Earthwork for Gas Service Piping

Earthwork shall be in accordance with Section 02300 EXCAVATION [, and for PE pipe or tubing the applicable requirements of ASTM D 2774]. Employ hand excavation within 1500 mm 5 feet of existing gas pipelines or other underground structures. [PE tubing may also be laid by the plow-in technique. The plow-in technique of laying tubing shall be accomplished by approved equipment especially designed for this type of work. The equipment shall have a vibratory plow, feed chute, soft rubber tubing cushion guide, and a tubing reel. The vibratory plow shall be capable of cutting a slit in the ground of width consistent with the size of the tubing and of depth to have the specified depth of cover over the tubing when laid. The unit shall be capable of feeding the tubing and the warning tape into the ground to the specified depth, without kinking. The reel shall be of a diameter appropriate for the tubing and shall operate smoothly. In the event the tubing breaks or kinks, the kink shall be cut out and a joint as herein specified for the material shall be made.]

3.3.8.2 Service Connections

Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main as close to the top as possible. Service connections shall not be made lower than the horizontal midpoint of the gas main. Install service connections in accordance with the applicable requirements of ASME B31.8.

3.3.8.3 Gas Service Piping Joints

- a. Steel Pipe: Make joints for steel service line piping as specified for steel distribution main piping.
- b. PE Pipe or Tubing: Make joints for PE pipe or tubing and fittings in accordance with ASME B31.8 and the recommendations of the manufacturer of the pipe or tubing and fittings.

3.3.8.4 Valve Installation on PE Service Lines

NOTE: When valves are to be installed in RTR or PE pipe or tubing, the project drawings shall include a detail showing the anchors to be installed and the technique to be used to ensure that no turning torque is imposed on the pipe.

Restrain curb cocks installed on PE service lines as indicated so that no turning torque can be transmitted to the pipe. Support curb boxes as indicated.

3.4 PROTECTION AGAINST CORROSION (FIELD APPLIED)

3.4.1 Corrosion Protection Systems

NOTE: A preliminary field survey of the area in which the gas distribution system is to be installed shall be made to determine the requirement for a cathodic protection system for metal gas piping and to obtain data on which to base the type and design of a cathodic protection system if required. The survey shall be accomplished as outlined in MIL-HDBK 1004/10, "Cathodic Protection," and shall be reviewed by the EFD cathodic protection specialist for verification of the results and recommendations. When existing piping is abandoned, removed, or replaced with plastic pipe, indicate modifications required to the existing cathodic protection system and specify testing to ensure continuity of the system.

Buried metallic gas pipe, fittings, and accessories installed on gas distribution systems shall be shop coated as specified [and cathodically protected as specified in Section [13110N CATHODIC PROTECTION BY GALVANIC ANODES] [13111N CATHODIC PROTECTION BY IMPRESSED CURRENT]]. Valves and other metallic components installed on buried plastic piping shall also be shop coated [and cathodically protected]. Paint metallic piping, fittings, and accessories aboveground and in vaults. Electrically isolate metallic pipe from other underground metallic structures, including metallic casings. After completing pressure tests, wrap joints and damaged areas of shop coatings with plastic tape as specified in paragraph entitled "Application of Plastic Tape," or coat using material and procedures recommended by the manufacturer of the pipe shop-coating.

3.4.2 Application of Plastic Tape

Apply plastic tape in the field to pipe joints and damaged areas of coatings. The joint area to be taped shall be clean and free of burrs and rust. Smooth down or cut away damaged coating if not firmly bonded to the pipe. Wrap spirally with a two-layer wrapping system, overlapping the coating surface at least 76 mm 3 inches. Initially stretch the tape sufficiently to conform to the surface to which it is applied, using one layer half-lapped for tape 50 mm 2 inches or less in width, or one layer lapped at least 25 mm one inch for tape more than 50 mm 2 inches wide. Apply a second layer lapped as above, with a tension as it comes off the roll, and press to conform to the shape of the component.

3.4.3 Coal Tar Base Coating

Apply in accordance with the manufacturer's written instructions.

3.4.4 Painting

Exposed metal gas piping, valves, and other accessories not specified as being shop coated or otherwise finished shall be cleaned in accordance with SSPC SP 3, painted as specified in Section 09900 PAINTS AND COATINGS. Touch up damaged shop coatings as required to restore them to original finish.

3.4.5 Installation of Insulating Fittings

NOTE: Lightning arrestors or grounding cells should be installed in those projects where aboveground pipe may be subject to excessive induced current and where the current might jump the insulating gap.

No deflection will be allowed in insulated mechanical joints. [Protect insulating joints connecting aboveground piping to buried, cathodically protected piping with [lightning arrestors] [zinc grounding cells] installed where indicated.] [[Lightning arrestors] [Zinc grounding cells] shall conform to applicable NEMA Standards.]

3.5 ABANDONED GAS LINES

NOTE: Show on the project drawings: Gas lines to be abandoned, including points of disconnect from the gas supply source, above-grade valves, risers, and vault and vault boxes.

NOTE: If the existing transmission or distribution system is cathodically protected, indicate on the drawings modifications required to maintain continuity of the cathodic protection system when existing lines are abandoned in place or abandoned and removed. Add specification text as required to address the modifications in this Section or in Sections 13110, "Cathodic Protection by Galvanic Anodes," or 13111, "Cathodic Protection by Impressed Current" as appropriate.

3.5.1 Lines Abandoned in Place

Physically disconnect lines abandoned in place from all sources of gas and purge or fill abandoned lines with water or other inert material. Air or inert gas may be used for purging. Purging shall continue until it has been determined that the volume of gas or liquid hydrocarbons remaining in the system poses no potential hazard. After purging is complete or system is filled with water, cap or plug all open ends.

3.5.1.1 Service Lines

Service lines abandoned from an active main shall be disconnected as close to the main as practicable.

3.5.1.2 Above-Grade Valves, Risers, and Vaults and Valve Boxes

All valves left in an abandoned line shall be closed. All above-grade valves, risers, and vault and valve box covers shall be removed; vault and valve box voids filled with suitable compacted material; and surface finished to match existing conditions.

3.5.2 Lines Abandoned and Removed

Disposition of material removed shall be in accordance with Section 02220 DEMOLITION.

3.6 FIELD QUALITY CONTROL

Do not coat, bury, cover or conceal joints and fittings until they have been inspected, tested and approved.

3.6.1 Inspection of Welds

Inspect quality of welded joints visually on a sampling basis. Repair defective welds or remove from the line and reweld piping.

3.6.2 Testing of Pipe Coatings

Check coated pipe for discontinuities in the coating with use of an electrical holiday detector at 10,000 volts prior to lowering into trench. Repair holidays in the pipe coating in accordance with paragraph entitled "Application of Plastic Tape."

3.6.3 Piping Strength and Tightness Tests

Test gas distribution system piping for leaks with air at 690 kPa (gage) 100 psig after construction and before being placed in service. Disconnect piping under test from live gas piping systems. Where possible, test main and service pipe as a unit. [Service line connections] [Pipe joints] which are not included in the pressure test shall be given a leakage test at normal operating pressure after the piping system is placed in operation. Maintain a permanent written record of pressure test performed.

3.7 PURGING LINES

Purge mains and service lines before placing in service in accordance with ASME B31.8.

3.8 FINAL CLEAN-UP

Upon completion of the work, remove and dispose of excess spoil and leave the areas in a clean condition. Restore service line trenches as nearly as possible to the original appearance and condition.

-- End of Section --