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SECTION 02555

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06/04

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SECTION 02555

GAS DISTRIBUTION SYSTEMS
06/04

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers site gas distribution systems for natural, manufactured, a mixture of manufactured and natural, and liquefied-petroleum gas (LPG).

Drawings must indicate dimensions, locations, elevations, connections, and valves.

Delete references to plastic pipe when an LPG distribution system is specified.

Consideration must be given to the possibility of corrosion due to electrolytic action or stray electrical current. If soil conditions indicate that this type of corrosion is possible, a study must be made to determine whether cathodic protection is required. Additions to existing systems that are cathodically protected shall be provided with cathodic protection. Cathodic protection shall be designed in accordance with TM 5-811-4.

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Excavation and backfill are specified in Section 02312 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

1.1.2 System Description

Lines shall include lines to, and connections with, the building service at a point approximately 5-feet 1500 millimeter outside the building and shall be steel or plastic pipe. Where building services are not installed, the Contractor shall terminate the service lines approximately 5-feet 1500 millimeter from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps.

1.2 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

AMERICAN GAS ASSOCIATION (AGA)

- AGA B109.1 (2000) Diaphragm-Type Gas Displacement Meters (Under 500 cubic ft./hour Capacity)
- AGA B109.2 (2000) Diaphragm-Type Gas Displacement Meters (500 cubic ft./hour Capacity and Over)
- AGA Manual (1994) Plastic Pipe Manual for Gas Service

AMERICAN PETROLEUM INSTITUTE (API)

- API Spec 6D (2002) Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves)
- API Std 1104 (1999; R 2001) Welding of Pipelines and Related Facilities

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- ASHRAE-06 (1997) Handbook, HVAC Systems and Equipment (IP Edition)
- ASHRAE-Hdbk SE-SI (2000) Handbook, HVAC Systems and Equipment (SI Edition)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA C203 (2002) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

AMERICAN WELDING SOCIETY (AWS)

- AWS WHB-2.8 (1991; 8th Ed) Welding Handbook; Volume Two - Welding Processes

ASME INTERNATIONAL (ASME)

- ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)
- ASME B1.21M (1997) Metric Screw Threads - MJ Profile

ASME B16.11	(2002) Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flanged Gaskets for Pipe Flanges
ASME B16.40	(2002) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2001) Power Piping
ASME B31.4	(2002) Pipeline Transportation Systems for Liquid Hydrocarbons, and Other Liquids
ASME B31.8	(2004) Gas Transmission and Distribution Piping Systems
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 181/A 181M	(2001) Standard Specification for Forgings, Carbon Steel, for General-Purpose Piping
ASTM A 234/A 234M	(2003) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperatures
ASTM A 420/A 420M	(2003) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service
ASTM A 53/A 53M	(2002) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 539	(1999) Standard Specification for Electric Resistance Welded Coiled Steel Tubing for Gas and Fuel Oil Lines
ASTM A 694/A 694M	(2003) Standard Specification for Forgings, Carbon and Alloy Steel, for Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service

ASTM D 1187	(1995) Asphalt Base Emulsions for Use as Protective Coatings for Metal
ASTM D 1248	(1984; R 1989) Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1784	(2003) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 2513	(2004) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(2000e1) Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM D 2564	(2002) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 3139	(1998) Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 4161	(2001) Standard Specification for Fiberglass (Glass-Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 1376	(1992) Standard Guide for Metallurgical Analysis for Gas Distribution System Components

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

MSS SP-84	(1990) Valves - Socket Welding and Threaded Ends
MSS SP-86	(2002) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

NACE INTERNATIONAL (NACE)

NACE RP0190	(1990) External Protective Coatings for Joints, Fittings and Valves on Metallic Underground or Submerged Pipelines and Piping Systems
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 58	(2004) Standard for Storage and Handling of Liquefied Petroleum Gases
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PLASTICS PIPE INSTITUTE (PPI)

PPI TN2 (1970) Sealants for Polyvinyl Chloride
(PVC) Plastic Piping

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3777A (1991) Tape, Nylon, Nonmelting, Reinforcing
TECHNICAL MANUAL (TM)

TM 5-848-1 (1991) Gas Distribution (AFM 88-12, Ch. 1)

UNDERWRITERS LABORATORIES (UL)

UL 25 (2003) UL Standard for Safety Meters for
Flammable and Combustible Liquids and LP
Gas

UL 6 (2003) UL Standard for Safety for
Electrical Rigid Metal Conduit-Steel

UL 842 (1999) UL Standard for Safety Valves for
Flammable Fluids

1.3 SUBMITTALS

**NOTE: Review submittal description (SD) definitions
in Section 01330 SUBMITTAL PROCEDURES and edit the
following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality
control. Include a columnar list of appropriate
products and tests beneath each submittal
description.**

The following shall be submitted in accordance with Section 01330 SUBMITTAL
PROCEDURES in sufficient detail to show full compliance with the
specification:

SD-02 Shop Drawings

The following drawings shall be submitted in accordance with
paragraph entitled, "Drawings," of this section.

Fabrication Drawings
Installation Drawings

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted for the following
items:

Flange Gaskets
Steel Pipe
Fittings for Steel Pipe
Pipe Threads

Valves
Identification Plates
Plastic Pipe and Fittings
Protective Systems

SD-06 Test Reports

Test reports shall be submitted for operational tests on gas distribution systems in accordance with the paragraph entitled, "Tests," of this section.

Inspection Reports shall be submitted in accordance with the paragraph entitled, "Inspection," of this section.

Records of Quality Control shall be maintained in accordance with the paragraph entitled, "Quality Control," of this section.

SD-07 Certificates

Certificates shall be submitted showing materials or equipment conform to the requirements of the Underwriters Laboratories, Inc. Underwriters Laboratories label or listing in the UL will be acceptable as sufficient evidence that the items conform. In lieu of such label or listing, the Contractor may submit a written certificate from a nationally recognized testing agency stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the Underwriters Laboratories.

Flange Gaskets
Steel Pipe
Fittings for Steel Pipe
Pipe Threads
Valves
Plastic Pipe and Fittings
Protective Covering

Welding Procedures shall be in accordance with the paragraph entitled, "Welding," of this section.

Certificates for Welder Qualifications shall be submitted in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

SD-08 Manufacturer's Instructions

The following shall be submitted in accordance with the paragraph entitled, "Instructions," of this section.

Manufacturer's Instructions
Posted Instructions

1.4 QUALITY ASSURANCE

Materials and equipment shall be the products of manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to the bid opening.

1.5 QUALIFICATIONS FOR WELDING WORK

NOTE: If Section 15055 WELDING MECHANICAL is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

Section 15055 WELDING MECHANICAL applies to work specified in this section.

[Each trade performing welding shall be responsible for the qualifying welding procedure for weldments. Welding procedures shall be qualified by conducting the tests required in ASTM A 539 and [ASME BPVC SEC IX] [AWS WHB-2.8] or as permitted by ASME B31.1.]

[Welder qualifications shall be submitted. Each welder shall be qualified by tests using equipment, procedures, and a base metal and electrode or filler wire from the same compatible group number that will be encountered in the applicable procedure. Performance qualifications shall be determined in accordance with ASTM A 539 and [ASME BPVC SEC IX] [AWS WHB-2.8]. Welders and welding operators may be accepted as permitted by ASME B31.1.

Government shall be notified 24 hours in advance of test; wherever practicable, the tests shall be performed at the site. A listing of the names and identification symbols, as noted on the performance qualification test records shall be furnished to be used to identify the work performed by the welder or welding operator. After completing a welded joint, the welder shall identify his work by applying his assigned symbol for the permanent record.]

1.6 HANDLING

During shipping, delivery, and installation, pipe and accessories shall be handled in a manner that will ensure a sound, undamaged condition. Particular care shall be taken not to injure pipe coating. Pipe or materials shall not be placed inside another pipe or fitting after the coating has been applied, except as specified. Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

NOTE: Delete the following paragraph if an LPG system is specified.

Plastic pipe shall be handled in conformance with ASME B31.4 and ASTM D 2517 and AGA Manual.

1.7 DRAWINGS

Fabrication Drawings shall be submitted for gas distribution systems consisting of fabrication and assembly details to be performed in the factory.

Installation Drawings shall be submitted for gas distribution systems in accordance with the manufacturer's recommended instructions.

1.8 QUALITY CONTROL

Contractor shall establish and maintain records of quality control. A copy

of records of inspections and tests shall be furnished.

1.9 INSTRUCTIONS

Manufacturer's Instructions shall be submitted for gas distribution systems including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

Posted Instructions shall be submitted including labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

PART 2 PRODUCTS

2.1 STEEL PIPE

Steel pipe shall conform to ASTM A 53/A 53M, Grade A or B, Type E or S; seamless or electric resistance-welded, black, wall thickness as required to meet ASTM F 1376, MSS SP-86 and ASME B31.8. Furnace butt-welded pipe may be used in sizes 1-1/2 inches DN40 and smaller. Pipe Threads shall conform to ASME B1.20.1 and ASME B1.21M.

2.1.1 Fittings for Steel Pipe

2.1.1.1 Threaded

Fittings shall conform to ASTM A 420/A 420M.

2.1.1.2 Welded

Butt-welded fittings shall conform to ASTM A 234/A 234M and ASME B16.9. Socket-welded fittings shall conform to ASME B16.11.

2.1.1.3 Flanged

Fittings shall conform to ASTM A 694/A 694M and ASME B16.5.

2.1.1.4 Forged Branch Connection

Connections shall conform to ASTM A 181/A 181M, Class 60, steel.

2.1.2 Valves

NOTE: Valves and pressure regulators are necessary at all points where design requires reduction in or regulation of pressure. A shutoff valve shall be installed upstream of the regulator. A central regulating station is generally provided by the gas company and is usually located near the entrance to Government property. When valves, gas pressure regulators, and related devices are provided in the contract, all necessary equipment shall comply with the requirements of the gas company, and these paragraphs will be revised as required. A detail of each regulating station in the contract will be shown and the following data will be provided 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.

Valves shall be suitable for shutoff or isolation service.

2.1.2.1 1-1/2 Inches DN40 or Smaller

Valves 1-1/2 inches DN40 or smaller installed underground shall conform to MSS SP-86 and MSS SP-84, carbon steel, socket weld ends, with square wrench operator adaptor.

Valves 1-1/2 inches DN40 or smaller installed aboveground shall conform to MSS SP-86 and MSS SP-84, carbon steel, [socket weld] [threaded] ends with [handwheel] [wrench] operator.

2.1.2.2 2 Inches DN50 and Larger

Valves 2 inches DN50 and larger installed underground shall conform to ASHRAE-06, Chapter 43, and API Spec 6D ASHRAE-Hdbk SE-SI, Chapter 43, carbon steel, buttweld, Class [_____] with square wrench operator adaptor.

Valves 2 inches DN50 and larger installed aboveground shall conform to ASHRAE-06 and API Spec 6D ASHRAE-Hdbk SE-SI, Chapter 43, carbon steel, [buttweld] [flanged], Class [_____] with [handwheel] [wrench] operator.

Valves 8 inches DN200 and larger shall be provided with worm or spur gear operators that are totally enclosed, grease packed, and sealed. Operator shall have open and close stops and a plug position indicator. Locking feature shall be provided where indicated. Wherever the lubricant connections are not conveniently accessible, suitable extensions for the application of lubricant shall be provided. Valves shall be provided with lubricant suitable for gas service.

2.1.3 Flange Gaskets

Flange gaskets shall conform to MSS SP-86 and ASME B16.21.

2.1.4 Sealants for Steel Pipe Threaded Joints

2.1.4.1 Sealing Compound

Joint Sealing compound shall be as listed in UL 6, Class 20 or less.

2.1.4.2 Tape

Tetrafluoroethylene tape shall conform to [PPI TN2] [SAE AMS 3777A], ASTM D 3139 and ASTM D 4161.

2.1.5 Identification Plates

Each major component of equipment shall display the manufacturer's name, address, and model number on a plate securely attached to the equipment.

2.2 VALVES, PLASTIC PIPE AND FITTINGS

NOTE: Delete the paragraph heading and the

following paragraphs when an LPG system is specified.

2.2.1 Polyethylene

Pipe shall conform to ASTM D 1248 and ASTM D 2513, Pipe Designations PE 2306, PE 2406 and PE 3306, designed for gas distribution.

2.2.2 Polyvinylchloride

Pipe shall conform to ASTM D 1784 and ASTM D 2513, Pipe Designations PVC 1120, PVC 1220, PVC 2110, and PVC 2116, designed for gas distribution.

2.2.3 Thermoplastic Valves

Thermoplastic valves for underground installation only, shall conform to ASME B16.40. Plastic valves in sizes 1/2-inch to 6 inches DN15 to DN150 may be used with polyethylene or fiberglass distribution and service lines as a Contractor option to steel valves subject to the limitations for fiberglass and plastic pipe specified herein.

2.2.4 Steel Valves in Plastic Lines

NOTE: Delete paragraph and heading when an LPG system is specified.

Valve installation in plastic lines shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from any other stresses which may be exerted through the valve or valve box.

2.3 VALVE BOXES

Cast-iron boxes, not less than 3/16-inch 5 millimeter thick, shall be provided at each underground valve, except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. The word GAS shall be cast in the cover. When the valve is located in a roadway, the valve box shall be protected against movement by a concrete slab at least 3-feet 1 meter square. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet 600 millimeter square and set flush with the sidewalk. Boxes shall be the adjustable extension type with screw or slide adjustments.

Rectangular reinforced concrete boxes with 8-inch 200 millimeter floors and sidewalls extending above the ground line shall be provided for all regulators, bypass lines, and valves as indicated on drawings. Boxes shall be provided with 4-inch 100 millimeter vents and cast-iron manhole covers with locking devices. The word GAS shall be cast in the cover. Overpressure protection to prevent gas pressure from exceeding a predetermined value shall be provided in accordance with ASTM F 1376, MSS SP-86 and ASME B31.8.

2.4 REGULATORS

NOTE: Valves and pressure regulators are necessary at all points where design requires reduction in or

regulation of pressure. A shutoff valve shall be installed upstream of the regulator. A central regulating station is generally provided by the gas company and is usually located near the entrance to Government property. When valves, gas pressure regulators, and related devices are provided in the contract, all necessary equipment will comply with the requirements of the gas company, and these paragraphs will be revised as required. A detail of each regulating station in the contract will be shown and the following data will be provided 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.

2.4.1 Bypass Lines

A bypass line of the same size as the main shall be installed around each regulator, and a lubricated plug valve shall be installed in the bypass line. A lubricated plug valve shall be installed on each side of each regulator, between the regulator and the bypass connections to the gas main. Connections suitable for attaching pressure gages and equipped with shutoff cocks shall be provided on each side of the bypass valve or at other approved locations.

2.4.2 Gas Main Regulators

Pressure regulators for main distribution lines, supplied from a source of gas which is at a higher pressure than the maximum allowable operating pressure for the system, shall have ferrous bodies and shall be equipped with pressure regulating devices of adequate capacity and be designed to meet the pressure, load and other service conditions under which they will operate or to which they may be subjected. In addition to the pressure regulating devices, a suitable method shall be provided to prevent overpressuring of the system in accordance with ASTM F 1376, MSS SP-86 and ASME B31.8. Suitable protective devices are as follows:

- a. Spring-loaded relief valve meeting the provisions of UL 842 and ASME BPVC SEC VIII D1.
- b. Pilot-loaded back pressure regulator used as relief valve, so designed that failure of the pilot system will cause the regulator to open.
- c. Weight-loaded relief valves.
- d. Monitoring regulator installed in series with the primary pressure regulator.
- e. Series regulator installed upstream from the primary regulator, set to limit the pressure on the inlet of the primary regulator continuously to the maximum allowable operating pressure of the system, or less.
- f. Automatic shutoff device installed in series with the primary regulator, set to shut off when the pressure on the distribution system reaches the maximum allowable operating pressure of the

system, or less. This device shall remain closed until manually reset.

- g. Spring-loaded, diaphragm-type relief valves.

2.4.3 Service Line Regulators

NOTE: If service regulator does not have all the characteristics listed, or if gas contains materials which would interfere with operation of the regulator, protective devices shall be installed to prevent overpressuring of the users, should the regulator fail. Consider the following devices to be installed as an integral part of the regulator or as separate devices operating in conjunction with the regulator:

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

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure (psi) to pressures required for users (inches of water column)Regulator shall read distribution line pressure in pascal. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column 2500 pascal. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulators for liquified petroleum gas shall be adjusted to 10 to 12 inches of water column 2500 to 3000 pascal. Pressure relief for liquified petroleum gas shall be set at 16 inches of water column 4000 pascal. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self-contained service regulator. Regulator pipe connections shall not exceed 2-inch DN50 size.

2.5 METERS

NOTE: Provide gas meters on single buildings. Where meters have a maximum anticipated demand of less than 1000 CFH 28 cubic meter per hour, the meter shall be specified for a design working pressure of 100 psi 690 kilopascal in lieu of 300 psi 2070 kilopascal specified in UL 25, AGA B109.1 and AGA B109.2. Provide meters on groups of buildings served by a single gas service line having a gas demand of 1000 SCFH 28 cubic meter per hour or greater. Remove brackets from appropriate mounting and special features and delete mounting and

features not required. Provide strainer upstream of meter if installed upstream of pressure regulator and delete brackets. For Air Force projects delete last set of brackets. Engineering Technical Letter Number 86-7 "Utility Meters in New and Renovated Facilities" provides guidance for when to exclude meters from Air Force new and major renovation projects.

Meters shall conform to UL 25, AGA B109.1 and AGA B109.2, without resettable counter. Meters shall be [pipe] [pedestal] mounted [and be provided with a strainer immediately upstream]. Meters shall be provided with [over-pressure, backflow, and vacuum protection as specified in ASTM F 1376, MSS SP-86 and ASME B31.8] [tamper-proof protection] [frost protection] [fungus-proof protection]. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. [Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall not provide less than one pulse per 100 cubic feet 2.8 cubic meter of gas.]

2.6 PROTECTIVE SYSTEMS

Protective covering for underground steel pipe shall be mechanically applied, except as specified. Special sections, valves, and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the factory. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in effectiveness to that of the mechanically applied covering. Pipe covering shall consist of one of the following.

2.6.1 Coal-Tar Coating and Wrapping

A coat of coal-tar primer, a coat of coal-tar enamel, a wrapper of [coal-tar-saturated non-asbestos] [natural or synthetic elastomer] felt, and a wrapper of kraft paper or a coat of water-resistant whitewash, shall be applied in conformance with the requirements of AWWA C203, except that an interior lining will not be required. When a corrosion survey, as required by TM 5-848-1, indicates the necessity, a second coat of coal-tar enamel and a second wrapper of [coal-tar-saturated non-asbestos] [natural or synthetic elastomer] felt shall be applied prior to the kraft paper wrapper.

Joints and fittings shall be coated and wrapped either in conformity with AWWA C203 or applied in accordance with the manufacturer's recommendations.

2.6.2 Plastic Resin

Plastic-resin coating system shall conform to NACE RP0190, thickness not less than 54 mils 1.4 millimeter where indicated or for pipe with outside diameter of 6.01 inches DN150 or larger. Coating joints shall be made with heat-shrinkable plastic-resin sleeves applied with factory-approved shrinking devices. Taped fitting and valve protection and repairs shall be made in accordance with the manufacturer's instructions. Electrical flaw detection testing at the factory shall require 10,000 volts to be impressed

across the coating. Coating breakdown voltage shall be not less than 13,000 volts.

2.6.3 Epoxy

Epoxy coating system shall conform to NACE RP0190. Fittings, valves, and joints shall be factory-coated with materials identical to those used on the pipe or may be field-coated with a two-part epoxy system as recommended by the applier of the pipe coating system. Field protection may also be provided to joints and fittings with a vinyl pressure-sensitive adhesive tape, 10-mils 0.25 millimeter minimum thickness, applied over a compatible primer. Tape shall conform to AWWA C203. Coated pipe shall be inspected for holidays using an electrical flaw detector that impresses 1,000-volts across the coating.

2.6.4 Cathodic Protection

Cathodic protection shall conform to the requirements of Section 13110 cathodic protection.

PART 3 EXECUTION

3.1 DISTRIBUTION SYSTEM

Materials and equipment shall be installed in accordance with the recommendations of the manufacturer.

NOTE: Delete the following paragraph and include the second paragraph if an LPG distribution system is specified.

Gas distribution system shall be installed in conformance with ASTM F 1376, MSS SP-86 and ASME B31.8.

Gas distribution system shall conform to the requirements of NFPA 58 and where applicable, ASME B31.4 and ASTM D 2517 and AGA Manual.

NOTE: Use of suitable plastic pipe shall be based on a chemical analysis of the gas to be supplied.

Plastic pipe must not be used when a LPG system is specified.

3.2 GAS MAINS

Mains shall be [steel] [plastic] as specified. Steel pipe fittings and special sections shall be coated with protective covering as specified. Plastic pipe shall not be installed aboveground in distribution systems having pressures that exceed 50 psig 350 kilopascal or where the operating temperatures of the materials will be below minus 20 or above 100 degrees F 29 or above 38 degrees C.

3.3 SERVICE LINES

Service lines shall be connected to gas mains as indicated. Service lines

shall be provided with shutoff plug valves of the same sizes as the service lines, where indicated. Plug valve shall be located near the supply main but at a safe distance from traffic lanes. Service lines shall be as short and straight as practicable between the building and gas main and shall not be bent or curved laterally, except to avoid obstructions or as otherwise directed. Steel pipe and fittings shall be covered with protective covering as specified. Service lines shall be laid with as few joints as feasible using standard lengths of pipe. Shorter lengths shall be used only for closures. Limitations on the use of plastic pipe shall be as specified.

3.4 INSTALLING UNDERGROUND PIPE

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded, except as permitted for installation of valves. Mains shall have a minimum cover of [24] [_____] inches [600] [_____] millimeter, and service lines shall have a minimum cover of [18] [_____] inches [460] [_____] millimeter, laid on firm soil for the full length. Where the trench has been excavated below grade, the trench shall be backfilled with suitable material and tamped to provide full-length bearing. Laying pipe on blocks to produce a uniform grade will not be permitted. Pipe shall be clean inside before it is lowered into trench and shall be maintained free of water, soil, and other foreign matter that might injure or obstruct operation of valves, regulators, burners, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other approved means.

[A single conductor No. 14 AWG 1.6 millimeter wire with type TW insulation shall be installed with plastic pipe to facilitate the pipe location.]

[The pipe shall be identified with a [_____] inch millimeter wide metal foil locator tape buried 12 inches 300 millimeter below grade.]

Minor changes in line or gradient of steel pipe that can be accomplished through flexibility of the pipe without producing permanent deformation and overstressing the joints may be made when approved. Changes in line or gradient that exceed the bend limitations specified shall be made with suitable fittings. Where indicated at crossings of gas mains under traffic lanes or railroads, pipe shall be laid inside a casing of standard weight black steel pipe provided with protective coating as specified. Vents and sealing of the casing shall be provided as indicated. Vents shall be provided with a copper or aluminum function-identification plate.

3.4.1 Markers

Every [_____] feet millimeter the underground pipe shall be identified by an "Underground Gas Main" plastic pipe marker.

3.5 INSTALLING ABOVEGROUND PIPE

The same precautions, where applicable, shall be taken to protect aboveground piping against dirt and foreign matter, as specified for underground piping. Plastic pipe shall not be installed above ground. Joints in steel pipe shall be welded, except joints in pipe 1 inch DN25 and smaller may be threaded, and except as otherwise permitted for installation of valves. Flanges shall be of the weld neck type to match the wall thickness of pipe.

3.6 JOINTING

3.6.1 Threaded Joints

Joints shall have tapered threads, evenly cut, and made with approved compound for gas service consisting of graphite compound or polytetrafluoroethylene tape, applied to the male threads only. After cutting and before threading, pipe shall be reamed and have burrs removed. Calking threaded joints to stop or prevent leaks will not be permitted.

3.6.2 Welded Joints

Changes in the direction of piping shall be made with welded fittings or forged branch-connection fittings. Mitering or notching the pipe to form elbows, tees, or other similar fittings will not be permitted, except as specified for forged branch-connection fittings.

Field and shop bevels shall be done by approved mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of scale and oxidation prior to welding.

Before welding, the component parts to be welded shall be aligned so that no strain is placed on the weld when it is finally positioned. Height shall be so aligned that no part of the pipe wall is offset by more than 20 percent of the wall thickness. Flanges and branches shall be set true. Alignment shall be preserved during the welding operation. If tack welds are used, they shall be of the same quality and made by the same procedure as the completed weld; otherwise, tack welds shall be removed during the welding operation.

Where the temperature of the component parts to be welded reaches 32 degrees F 0 degrees C or lower, the pipe shall be heated to approximately 100 degrees F 38 degrees C before welding, and the weld shall be completed before the material cools to 32 degrees F 0 degrees C.

Electrodes shall be stored in a dry, heated area and shall be kept free of moisture or dampness. Electrodes that have lost part of their coating shall be discarded.

3.6.3 Joints in Plastic Pipe

Polyethylene joints shall be made by heat fusion with socket fittings in conformance with ASME B31.4 and ASTM D 2517 and AGA Manual. Polyvinylchloride joints shall be made with solvent cement conforming to ASTM D 2564 in conformance with ASME B31.4 and ASTM D 2517 and AGA Manual.

3.7 PIPE CUTTING

Cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by means of an approved type of mechanical cutter. Wheel cutters shall be used where practical. On pipe 6 inches DN150 and larger, an approved gas cutting-and-beveling machine may be used. Cutting plastic pipe shall be in accordance with ASME B31.4 and ASTM D 2517 and AGA Manual.

3.8 DRIPS

Drips shall be installed at locations where indicated. Drips shall conform to the details indicated or may be of commercial manufacture approved as to

type and capacity. A blowoff pipe, 1-1/4 inches DN32 or larger, shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location outside of traffic. A discharge terminal shall be provided with a reducing fitting, plug valve, and 1/2-inch 13 millimeter nipple turned down. Discharge terminal shall be inside a length of 12 inch 300 millimeter or larger vitrified-clay pipe or concrete sewer pipe set vertically on a bed of coarse gravel 1-foot 300 millimeter thick and 3-feet 900 millimeter square, closed at the ground surface with a replacement cover.

3.9 CONNECTIONS TO EXISTING LINES

Connections between new work and existing gas lines, where required, shall be approved, using proper specials and fittings to suit the actual conditions in accordance with ASTM F 1376, MSS SP-86 and ASME B31.8. When connections are made by tapping into a gas main, the connecting fitting shall be the same size as the pipe to be connected.

3.10 INSPECTION

Inspection Reports shall be submitted identifying activity by contract number, location, craft discipline, quantity of material placed, and timed events or milestones.

3.10.1 Welding

Welds shall be inspected visually in accordance with the requirements of ASTM F 1376, MSS SP-86 and ASME B31.8. Defective welds shall be removed and replaced at no additional cost to the Government. Repairing defective welds by adding new material over the defects or by peening will not be permitted.

NOTE: Include the following paragraph when the system is intended to operate at 20 percent or more of the minimum yield strength of the pipe.

In addition to the visual inspection of welds, inspection of production welds shall be made by radiographic or ultrasonic means. A minimum of one welded joint per 50 feet 1525 millimeter of welding, selected at random, shall be examined. Nondestructive inspection shall be performed, processed, and interpreted only by experienced technicians. Radiographic inspection and interpretation shall conform to API Std 1104.

3.10.2 Pipe Coating

Damage to the protective covering shall be repaired by the Contractor at no additional cost to the Government. Field coating and wrapping shall be subject to approval. After coating and wrapping have been applied, the entire pipe shall be inspected with an electric holiday detector having the test voltage specified, using a full-ring spring-type coil electrode. Holiday detector shall be equipped with a bell, buzzer, or other type of audible signal that operates when a holiday is detected. Holidays in the protective covering shall be repaired immediately upon detection. Occasional checks of holiday detector potential shall be made to determine suitability of the detector. Inspection for holidays shall be performed just prior to covering the pipe with backfill. Every precaution shall be taken during backfill to prevent damage to the protective covering.

3.11 TESTS

Contractor shall prove that the entire system of gas mains and service lines included in the contract is gastight by an air test under a pressure of 45 psig 310.3 kilopascal or not less than 50 percent more than the operating pressure, whichever is greater.

3.11.1 Test of Gas Mains

Tests shall be made on the system as a whole or on the sections that can be closed off by the valves indicated. Smaller sections may be tested when backfilling the trenches in such sections, in advance of the completion of other sections, if essential. Test shall continue for at least 24 hours between the times of the initial and final readings of pressure and temperature. Initial test readings of the instruments shall not be made for at least 1 hour after the pipe has been subjected to the test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. Temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T_1P_2=T_2P_1$, in which T and P denote absolute temperature and pressure, respectively, and the numerals denote initial and final readings. During the test, the entire system shall be completely isolated from sources of air pressure. Testing instruments shall be approved and shall be subject to inspection at all times during the test. If so required, the test shall be made with instruments supplied by the Government.

3.11.2 Test of Service Lines

Service lines shall be tested with the gas mains or may be tested separately with soapsuds applied at the pipe joints.

3.12 PAINTING AND FINISHING

Pressure regulators and valves exposed in valve boxes or manholes shall be cleaned and given a coat of asphalt varnish conforming to ASTM D 1187. Piping exposed in valve boxes or manholes shall be coated as specified.

-- End of Section --