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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated March 2008

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

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GAS PIPING SYSTEMS

10/07

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SECTION 23 11 23.00 10

GAS PIPING SYSTEMS
10/07

NOTE: This guide specification covers the requirements for low pressure (3.45 kPa (0.5 psig) maximum) gas systems conforming to NFPA 54/ANSI Z223.14 for nonindustrial uses.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

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).

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the

Reference Wizard's Check Reference feature to update
the issue dates.

References not used in the text will automatically
be deleted from this section of the project
specification when you choose to reconcile
references in the publish print process.

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA XR0104 (2006) AGA Plastic Pipe Manual for Gas
Service

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (2002; Errata 2005) Specification for
Pipeline Valves

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General
Purpose (Inch)

ASME B16.11 (2005) Forged Fittings, Socket-Welding and
Threaded

ASME B16.21 (2005) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.3 (2006) Malleable Iron Threaded Fittings,
Classes 150 and 300

ASME B16.33 (2002) Manually Operated Metallic Gas
Valves for Use in Gas Piping Systems Up to
125 psi, Sizes NPS 1/2 - NPS 2

ASME B16.5 (2003) Standard for Pipe Flanges and
Flanged Fittings: NPS 1/2 Through NPS 24

ASME B16.9 (2003) Standard for Factory-Made Wrought
Steel Buttwelding Fittings

ASME B31.1 (2007) Power Piping

ASME B31.2 (1968) Fuel Gas Piping

ASME B36.10M (2004) Standard for Welded and Seamless
Wrought Steel Pipe

ASME BPVC SEC IX (2007) Boiler and Pressure Vessel Code;
Section IX, Welding and Brazing
Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A 513	(2007) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM B 210	(2004) Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 210M	(2005) Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)
ASTM B 241/B 241M	(2002) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 280	(2003) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D 2513	(2007b) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(2006) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

CSA AMERICA, INC. (CSA/AM)

CSA/AM ANSI LC4	(2007) Press-Connect Copper and Copper Alloy Fittings for Use in Fuel Gas Distribution Systems
CSA/AM Z21.24	(2006) Connectors for Gas Appliances
CSA/AM Z21.69	(2002; R 2007) Connectors for Movable Gas Appliances

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

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (2006) National Fuel Gas Code

NFPA 70 (2007) National Electrical Code - 2008 Edition

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6 (2000; E 2004) Commercial Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir (2006) Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

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, Air Force, and NASA projects.

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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gas Piping System

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

SD-03 Product Data

Welding

Qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Gas Piping System

Catalog data and installation instructions for pipe, valves, and all related system components

SD-06 Test Reports

Testing

Pressure Tests

Pressure Tests for Liquified Petroleum Gas

Test With Gas

Test reports in booklet form tabulating test and measurements performed. The reports shall be dated after award of this contract, shall state the Contractor's name and address, shall name the project and location, and shall list the specific requirements which are being certified.

1.3 GENERAL REQUIREMENTS

1.3.1 Welding

NOTE: When the need exists for more stringent welding requirements, the designer may develop an alternate paragraph from industry standards using the applicable portions of Section 43 02 00 WELDING PRESSURE PIPING as a guide.

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified at least 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05 05 23 WELDING, STRUCTURAL.

1.3.2 Jointing Thermoplastic and Fiberglass Piping

Piping shall be jointed by performance qualified joiners using qualified procedures in accordance with [AGA XR0104](#). Plastic Pipe Manual for Gas Service. The Contracting Officer shall be furnished with a copy of qualified procedures and list of and identification symbols of qualified joiners.

1.3.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with [MSS SP-25](#).

1.3.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

NOTE: When acceptable to the serving gas supplier aluminum, thermoplastic or fiberglass pipe; copper, aluminum alloy, or steel tubing may be used with gases not corrosive to such materials. Before selecting aluminum, copper, thermoplastic or fiberglass materials, the gas supplier should be contacted for a gas analysis to determine the types of chemicals which will be in the gas supply. Suitable materials will be selected based on the gas analysis. In general, odorized gas is not suitable for aluminum or copper bearing materials.

2.1.1 Steel Pipe, Joints, and Fittings

NOTE: Other materials, such as threaded ductile iron, copper or brass pipe in iron pipe sizes, may be used with gases noncorrosive to such materials. Designer may specify other approved materials, but shall list proper reference publications in this paragraph and reference paragraph. Designer also may delete materials or equipment listed if not desirable or applicable.

Steel pipe shall conform to [ASME B36.10M](#). Malleable-iron threaded fittings shall conform to [ASME B16.3](#). Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with

ASME B16.5. Wrought steel butt welding fittings shall conform to ASME B16.9. Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

2.1.2 Aluminum Alloy Pipe and Tubing, Joints, and Fittings

Aluminum alloy pipe shall conform to ASTM B 241/B 241M, except alloy 5456 shall not be used, and the ends of each length of pipe shall be marked indicating it conforms to NFPA 54. Pipe joints shall be threaded, flanged, brazed or welded. Aluminum alloy tubing shall conform to ASTM B 210M ASTM B 210, Type A or B, or ASTM B 241/B 241M, Type A or equivalent. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

2.1.3 Copper Tubing, Joints and Fittings

Copper tubing shall conform to ASTM B 88M ASTM B 88, Type K or L, or ASTM B 280. Tubing joints shall be made up with tubing fittings recommended by the tubing manufacturer. Copper and copper alloy press fittings shall conform to CSA/AM ANSI LC4. Sealing elements shall be of Hydrogenated Nitrile Butadiene Rubber (HNBR) and be factory installed or an alternative supplied by the fitting manufacturer.

2.1.4 Steel Tubing, Joints and Fittings

Steel tubing shall conform to ASTM A 513. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

2.1.5 Thermoplastic Pipe, Tubing, Joints, and Fittings

Thermoplastic pipe, tubing, joints and fittings shall conform to ASTM D 2513.

2.1.6 Fiberglass Pipe, Joints, and Fittings

Fiberglass piping systems shall conform to ASTM D 2517.

2.1.7 Sealants for Steel Pipe Threaded Joints

Joint sealing compound shall be listed in UL Gas&Oil Dir, Class 20 or less. Tetrafluoroethylene tape shall conform to UL Gas&Oil Dir.

2.1.8 Identification

Pipe flow markings and metal tags shall be provided as required.

2.1.9 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1.6 mm 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 316 degrees C 600 degree F service. NBR binder shall be used for hydrocarbon service.

2.1.10 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.11 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing metallic and thermoplastic or fiberglass pipe. Approved transition fittings are those that conform to AGA XR0104 requirements for transitions fittings.

2.1.13 Insulating Pipe Joints

2.1.13.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.1.13.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

2.1.13.3 Flanged Pipe Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

2.1.14 Flexible Connectors

Flexible connectors for connecting gas utilization equipment to building gas piping shall conform to CSA/AM Z21.24. Flexible connectors for movable food service equipment shall conform to CSA/AM Z21.69.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Valves 50 mm 2 Inches and Smaller

Valves 50 mm 2 inches and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

2.2.2 Valves 65 mm 2-1/2 Inches and Larger

Valves 65 mm 2-1/2 inches and larger shall be carbon steel conforming to API Spec 6D, Class 150.

2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 METERS, REGULATORS AND SHUTOFF VALVES

NOTE: Interior and exterior meter, pressure regulator and shutoff valve will be specified in Section 33 51 03.00 10 GAS DISTRIBUTION SYSTEM. If that section is not a part of the contract specifications applicable paragraphs should be specified in this specification.

Meters, regulators and shutoff valves shall be as specified in Section 33 51 03.00 10 GAS DISTRIBUTION SYSTEM.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 31 00 00 EARTHWORK.

3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the [meter set assembly] [service regulator] [shutoff valve], specified in Section 33 51 03.00 10 GAS DISTRIBUTION SYSTEM, to the connections to each gas utilization device.

3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

3.3 PROTECTIVE COVERING

3.3.1 Underground Metallic Pipe

Buried metallic piping shall be protected from corrosion with protective coatings as specified in Section 33 51 03.00 10 GAS DISTRIBUTION SYSTEM. When dissimilar metals are joined underground, gastight insulating fittings shall be used.

3.3.2 Aboveground Metallic Piping Systems

NOTE: This paragraph applies to normal interior and exterior conditions. Where severe corrosion is expected, paragraph should be edited to provide for protection against corrosion.

3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be [mechanically cleaned by power wire brushing] [or] [commercial sand blasted conforming to [SSPC SP 6](#)] and primed with [ferrous metal primer] [or] [vinyl type wash coat]. Primed surface shall be finished with two coats of exterior [oil paint] [or] [vinyl paint].

3.3.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, nonferrous surfaces shall not be painted. Surfaces of aluminum alloy pipe and fittings shall be painted to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. The surfaces shall be solvent-cleaned and treated with vinyl type wash coat. A first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd copolymer enamel shall be applied.

3.4 INSTALLATION

NOTE: If underground piping is subject to physical damage, deeper burial depths should be specified to protect piping.

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of [NFPA 54](#), [AGA XR0104](#), and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe [150 mm 6 inches](#) and larger, an approved gas cutting and beveling machine may be used. Cutting of thermoplastic and fiberglass pipe shall be in accordance with [AGA XR0104](#).

3.4.1 Metallic Piping Installation

Underground piping shall be buried a minimum of [450 mm 18 inches](#) below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Aluminum alloy pipe shall not be used in exterior locations or underground.

3.4.2 Metallic Tubing Installation

Metallic tubing shall be installed using gas tubing fittings approved by the tubing manufacturer. Branch connections shall be made with tees. All tubing end preparation shall be made with tools designed for the purpose. Aluminum alloy tubing shall not be used in exterior locations or underground.

3.4.3 Thermoplastic and Fiberglass Piping, Tubing, and Fittings

Thermoplastic and fiberglass piping, tubing, and fittings shall be

installed outside and underground only. Piping shall be buried a minimum of 450 mm 18 inches below grade. The piping shall be installed to avoid excessive stresses due to thermal contraction. Thermoplastic and fiberglass piping shall only be allowed as indicated.

3.4.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

3.4.5 Piping Buried Under Buildings

Underground piping installed beneath buildings shall be run in a steel pipe casing protected from corrosion with protective coatings as specified in Section 33 51 03.00 10 GAS DISTRIBUTION SYSTEM. The casing shall extend at least 100 mm 4 inches outside the building. The pipe shall have spacers and end bushings to seal at both ends to prevent the entrance of water and escape of gas. A vent line from the annular space shall extend above grade outside to a point where gas will not be a hazard and shall terminate in a rain- and insect-resistant fitting.

3.4.6 Concealed Piping in Buildings

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

3.4.6.1 Piping in Partitions

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

3.4.6.2 Piping in Floors

NOTE: When acceptable to the serving gas supplier
gas piping may be embedded in portland cement
concrete floor slabs. If acceptable, delete
brackets.

Piping in solid floors [except where embedment in concrete is indicated] shall be laid in channels suitably covered to permit access to the piping with minimum damage to the building. [Piping embedded in concrete shall be surrounded by a minimum of 40 mm 1-1/2 inches of concrete and shall not be in physical contact with other metallic items such as reinforcing rods or electrically neutral conductors. Piping shall not be embedded in concrete slabs containing quickset additives or cinder aggregate.]

3.4.7 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 150 mm 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

3.4.8 Final Gas Connections

NOTE: Only allow flexible connectors where they will not be vulnerable to physical abuse or will not be accessible to unqualified personnel. Acceptable locations would include locked equipment rooms, equipment suspended at least 3 meters (10 feet) above floor, and remote buildings with limited accessibility by unqualified personnel. If flexible connectors are allowed, include bracketed sentence prohibiting connectors from passing through the equipment cabinet.

Unless otherwise specified, final connections shall be made with rigid metallic pipe and fittings. [Final connections to kitchen ranges shall be made using flexible connectors not less than 1.02 m 40 inch long. Flexible connectors may be used for final connections to residential dryers.] [Flexible connectors may be used for final connections to gas utilization equipment.] [In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet.] Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.4.9 Seismic Requirements

NOTE: Provide seismic details and show on the drawings. Delete bracketed phrase if no seismic details are provided.

Piping and attached valves shall be supported and braced to resist seismic loads as specified in UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT [as shown on the drawings].

3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 40 mm 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 50 mm 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

3.5.2 Welded Metallic Joints

Beveling, alignment, heat treatment, and inspection of welds shall conform

to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

3.5.3 Thermoplastic and Fiberglass Joints

NOTE: Thermoplastic and fiberglass pipe should not be installed where temperature will be below minus 29 degrees C (20 degrees F) or above 38 degrees C (100 degrees F). Fiberglass pipe may be used at temperatures up to 66 degrees C (150 degrees F), providing the pipe is marked in accordance with ASTM D 2513.

Jointing procedures shall conform to AGA XR0104. Solvent cement or heat of fusion joints shall not be made between different kinds of plastics.

3.5.4 Flared Metallic Tubing Joints

Flared joints in metallic tubing shall be made with special tools recommended by the tubing manufacturer. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Metallic ball sleeve compression-type tubing fittings shall not be used for tubing joints.

3.5.5 Solder or Brazed Joints

Joints in metallic tubing and fittings shall be made with materials and procedures recommended by the tubing supplier. Joints shall be brazed with material having a melting point above 538 degrees C 1000 degrees F. Brazing alloys shall not contain phosphorous.

3.5.6 Joining Thermoplastic or Fiberglass to Metallic Piping or Tubing

When compression type mechanical joints are used, the gasket material in the fittings shall be compatible with the plastic piping and with the gas in the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting, and the stiffener shall be flush with end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. A split tubular stiffener shall not be used.

3.5.7 Press Connections

Make press connections in accordance with manufacturer's installation instructions using tools approved by the manufacturer. Fully insert the tubing into the fitting and then mark at the shoulder of the fitting. Check the fitting alignment against the mark on the tubing to assure the tubing is fully inserted before the joint is pressed.

3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. All rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall extend at least 100 mm 4 inches above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 6.4 mm 1/4 inch all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07 84 00 FIRESTOPPING.

3.7 PIPES PENETRATING WATERPROOFING MEMBRANES

Pipes penetrating waterproofing membranes shall be installed as specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.8 FIRE SEAL

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07 84 00 FIRESTOPPING.

3.9 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.10 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

3.11 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched. Piping supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer.

3.12 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a

clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the common base member. A clearance of 3.2 mm 1/8 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.13 ELECTRICAL BONDING AND GROUNDING

The gas piping system within the building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70. Conventional flange joints allow sufficient current flow to satisfy this requirement.

3.14 SHUTOFF VALVE

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.15 CATHODIC PROTECTION

NOTE: Designs are required to have cathodic protection for underground ferrous gas piping regardless of soil condition. Other guidance is available in TM 5-811-7. Additions to existing systems will be provided with cathodic protection. Stations will be provided for testing the cathodic protection system.

Cathodic protection shall be provided for underground ferrous gas piping as specified in [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)].

3.16 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

3.16.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 21 kPa 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 1 kPa

0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

3.16.2 Pressure Tests for Liquified Petroleum Gas

Systems shall withstand the pressure test described above. When appliances are connected to the piping system, fuel gas shall be used for testing and appliances shall withstand a pressure of not less than 2.5 kPa nor more than 3.5 kPa 10.0 inches nor more than 14.0 inches water column (8.0 ounces per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a water manometer or an equivalent device calibrated to be read in increments of not greater than 20 Pa 0.1 inch water column. The source of pressure shall be isolated before the pressure tests are made.

3.16.3 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

3.16.4 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

3.16.5 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

3.17 PIPE COLOR CODE MARKING

NOTE: Designer will coordinate color code marking
with Section 09 90 00. Color code marking for
piping not listed in Table I of Section 09 90 00 will
be added to the table.

Color code marking of piping shall be as specified in Section 09 90 00
PAINTS AND COATINGS.

-- End of Section --