SECTION 231126 - FACILITY LIQUEFIED-PETROLEUM GAS PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Pipes, tubes, and fittings.

Piping specialties.

Piping and tubing joining materials.

Valves.

Pressure regulators. Service meters.

Storage containers.

Transport truck unloading facility specialties.

Pumps.

Vaporizers.

Air mixers.

Concrete bases.

* + - 1. DEFINITIONS

Retain definitions remaining after this Section has been edited.

* + - * 1. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
				2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
				3. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
				4. LPG: Liquefied-petroleum gas.
			1. PERFORMANCE REQUIREMENTS
				1. Minimum Operating-Pressure Ratings:

Revise pressure ratings in three subparagraphs below to suit Project. Ratings must be at least one and one-half times the system's operating pressure.

For Piping Containing Only Vapor:

Piping and Valves: [**125 psig] <Insert pressure**> unless otherwise indicated.

For Piping Containing Liquid:

Piping between Shutoff Valves: [**350 psig] <Insert pressure**> unless otherwise indicated.

Piping Other Than Above: [**250 psig] <Insert pressure**> unless otherwise indicated.

Valves and Fittings: [**250 psig] <Insert pressure**> unless otherwise indicated.

Pressure at meter, if downstream from regulator, should be 5 psig (34.5 kPa) or lower for most applications. NFPA 54 limits the pressure for undiluted LPG vapor to maximum 20 psig (138 kPa.) If service meters and regulators with more than one pressure rating are required, indicate location of each on Drawings along with their outlet pressure setting.

Minimum Operating Pressure of Service Meter: [5 psig**] [**10 psig**] [**20 psig**] [**65 psig**] <Insert pressure**>.

Retain one of first four paragraphs below. NFPA 54 limits the pressure for LPG in buildings to maximum 5 psig (34.5 kPa) unless specific construction details are followed, such as all welded piping, and venting pipe chases to outside.

* + - * 1. LPG System Pressure within Buildings: One pressure range. [**0.5 psig or less] [More than 0.5 psig but not more than 2 psig] [More than 2 psig but not more than 5 psig**].
				2. LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig and is reduced to secondary pressure of 0.5 psig or less.
				3. LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig.
				4. LPG System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig and is reduced to secondary pressures of more than 0.5 psig but not more than 2 psig and is reduced again to pressures of 0.5 psig or less.
				5. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Retain paragraph below with "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article for projects requiring seismic design. Model building codes and SEI/ASCE 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

* + - * 1. Seismic Performance: Vaporizers and storage container supports shall withstand the effects of earthquake motions determined according to [**SEI/ASCE 7] <Insert requirement**>.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of the following:

Piping specialties.

Corrugated stainless-steel tubing with associated components.

Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

Pressure regulators. Indicate pressure ratings and capacities.

Service meters. Indicate[ **pressure ratings and**] capacities. Include [**bypass fittings**] [**bypass fittings and meter bars] [meter bars] [supports**].

Dielectric fittings.

Storage containers.

Transport truck unloading specialties.

Pumps.

Vaporizers.

Air mixers.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings: For facility LPG piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

Shop Drawing Scale: [**1/4 inch per foot] <Insert scale**>.

Retain service meter assembly option in subparagraph below if Contractor installs service meter.

Detail mounting, supports, and valve arrangements for[ **service meter assembly and**] pressure regulator assembly.

Paragraph below is defined in Section 013300 "Submittal Procedures" as a "Delegated-Design Submittal." Retain if Work of this Section is required to withstand specific design loads and design responsibilities have been delegated to Contractor or if structural data are required as another way to verify compliance with performance requirements. if design was finished during design phase, by design professionals, and incorporated in the contract documents, remove "calculation", "analysis data" and "signed and sealed by the Professional Engineer" requirements.

For acceptable reason, if full design can't be finished during design phase, delegated design submittal, including calculations, shall be provided by the contractor per this paragraph..

* + - * 1. Delegated-Design Submittal: For LPG piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Detail fabrication and assembly of seismic restraints.

Design Calculations: Calculate requirements for selecting seismic restraints.

Retain first paragraph below if Drawings do not include detailed plans or if Project involves unusual coordination requirements.

* + - * 1. Coordination Drawings: Plans and details, drawn to scale, on which LPG piping is shown and coordinated with other installations, using input from installers of the items involved.

Retain first paragraph below if retaining "Project Conditions" Article.

* + - * 1. Site Survey: Plans, drawn to scale, on which LPG piping is shown and coordinated with other services and utilities.
				2. Qualification Data: For qualified Professional Engineer.

Retain first paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See SEI/ASCE 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Submit certification that vaporizer, air mixer, storage container supports, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain first paragraph below if retaining procedures for welder certification in "Quality Assurance" Article.

* + - * 1. Welding certificates.
				2. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For LPG equipment and accessories to include in emergency, operation, and maintenance manuals.
			2. QUALITY ASSURANCE

Retain one or both of first two paragraphs below for welding supports. Retain first for welded piping supports and retain second for welded steel pipe joints. If retaining, also retain "Welding certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
				2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
				3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
			1. DELIVERY, STORAGE, AND HANDLING

Retain this article for projects involving existing systems.

* + - * 1. Handling Flammable Liquids: Remove and dispose of liquids from existing LPG piping according to requirements of authorities having jurisdiction.
				2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
				3. Store pipes and tubes with protective PE coating to avoid damaging coating and protect from direct sunlight.
				4. Protect stored PE pipes and valves from direct sunlight.
			1. PROJECT CONDITIONS

Retain this article for outdoor piping and if Contractor is required to provide survey.

* + - * 1. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

Retain first paragraph below if interruption of existing LPG service is required.

* + - * 1. Interruption of Existing LPG Service: Do not interrupt LPG service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide purging and startup of LPG supply according to requirements indicated:

Notify [**Director’s Representative**] no fewer than [**two] <Insert number**> days in advance of proposed interruption of LPG service.

Do not proceed with interruption of LPG service [**Director’s Representative’s**] written permission.

* + - 1. COORDINATION
				1. Coordinate sizes and locations of concrete bases with actual equipment provided.
				2. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."
1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PIPES, TUBES, AND FITTINGS

This article includes examples of materials listed in NFPA 58, "Liquefied Petroleum Gas Code"; NFPA 54, "National Fuel Gas Code"; and the 2003 International Fuel Gas Code, which has been jointly adopted by AGA and ICC. Coordinate piping materials in this article with piping schedules in Part 3. See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to edit this Section.

See Part 3 piping schedule articles to determine where pipes, tubes, fittings, and joining materials are applied in various services.

* + - * 1. Steel Pipe: ASTM A53, black steel, Schedules 40 and 80, Type E or S, Grade B.

Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

Wrought-Steel Welding Fittings: ASTM A234 for butt welding and socket welding.

Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

Material Group: 1.1.

End Connections: Threaded or butt welding to match pipe.

Lapped Face: Not permitted underground.

Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

Bolts and Nuts: ASME B18.2.1, carbon steel aboveground, and stainless steel underground.

Retain first subparagraph below for underground steel piping. Cathodic protection may be required in addition to protective coating. Coordinate with requirements in Section 134713 "Cathodic Protection."

Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

Verify acceptability of couplings in first subparagraph below with authorities having jurisdiction before retaining. These couplings are available in NPS 1 (DN 25) and larger.

Mechanical Couplings:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Baker Hughes Company.

Smith-Blair, Inc.

Victaulic

Approved equivalent.

[**Stainless-steel] [Steel**] flanges and tube with epoxy finish.

Buna-nitrile seals.

[**Stainless-steel] [Steel**] bolts, washers, and nuts.

Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

Tubing in first paragraph below is limited in application to 0.5 psig (3.45 kPa) and less and NPS 1 (DN 25) and smaller. Verify acceptability with authorities having jurisdiction before retaining.

* + - * 1. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

FlashShield Products; Gastite, a division of Titeflex Corp.

TracPipe CounterStrike; Omega Flex, Inc.

Tru-Flex Metal Hose Corp.

Ward Manufacturing LLC.

Approved equivalent.

Tubing: ASTM A240, corrugated, Series 300 stainless steel.

Coating: PE with flame retardant.

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: [**25] <Insert value**> or less.

Smoke-Developed Index: [**50] [450] <Insert value**> or less.

Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.

Striker Plates: Steel, designed to protect tubing from penetrations.

Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

Operating-Pressure Rating: 5 psig.

Verify acceptability of tubing in first paragraph below with authorities having jurisdiction before retaining.

* + - * 1. Aluminum Tubing: Comply with ASTM B210 and ASTM B241.

Aluminum Alloy: Alloy 5456 is prohibited.

Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.

Flare Fittings: Comply with ASME B16.26 and SAE J513.

Copper-alloy fittings.

Metal-to-metal compression seal without gasket.

Dryseal threads shall comply with ASME B1.20.3.

CSA B149.1 allows the use of ASTM B837 copper tubing, which defines "Type G."

* + - * 1. Drawn-Temper Copper Tube: Comply with [**ASTM B88, Type K] [ASTM B88, Type L] [ASTM B837, Type G**].

Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

Retain subparagraph below for underground copper tubing. Cathodic protection may be required in addition to protective coating. Coordinate with requirements in Section 134713 "Cathodic Protection."

Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

In first paragraph below, CSA B149.1 allows the use of ASTM B837 copper tubing, which defines "Type G."

* + - * 1. Annealed-Temper Copper Tube: Comply with [**ASTM B88, Type K] [ASTM B88, Type L] [ASTM B837, Type G**].

Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

Verify acceptability of fittings in first subparagraph below with authorities having jurisdiction before retaining.

Flare Fittings: Comply with ASME B16.26 and SAE J513.

Copper fittings with long nuts.

Metal-to-metal compression seal without gasket.

Dryseal threads complying with ASME B1.20.3.

Retain subparagraph below for underground copper tubing. Cathodic protection may be required in addition to protective coating. Coordinate with requirements in Section 134713 "Cathodic Protection."

Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

Tube in first paragraph below is available in 1/4- to 5/8-inch OD and is equivalent to NPS 1/8 to NPS 1/2 (DN 6 to DN 15).

* + - * 1. Tin-Lined Copper Tube: ASTM B280, seamless, annealed, with interior tin-plated lining.

Verify acceptability of fittings in first subparagraph below with authorities having jurisdiction before retaining.

Flare Fittings: Comply with ASME B16.26 and SAE J513.

Copper fittings with long nuts.

Metal-to-metal compression seal without gasket.

Dryseal threads complying with ASME B1.20.3.

Some sizes of PE pipe may not be available in SDR 11.

* + - * 1. PE Pipe: ASTM D2513, SDR 11.

PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.

PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53, black steel, Schedule 40, Type E or S, Grade B.

See Evaluations for discussion of service-line risers. Retain one of first two subparagraphs below for anodeless or transition service-line riser for PE pipe.

Anodeless Service-Line Risers: Factory fabricated and leak tested.

Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.

Casing: Steel pipe complying with ASTM A53, Schedule 40, black steel, Type E or S, Grade B with corrosion-protective coating covering.[ **Vent casing aboveground**.]

Aboveground Portion: PE transition fitting.

Outlet shall be threaded or flanged or suitable for welded connection.

Tracer wire connection.

Ultraviolet shield.

Stake supports with factory finish to match steel pipe casing or carrier pipe.

Transition Service-Line Risers: Factory fabricated and leak tested.

Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.

Outlet shall be threaded or flanged or suitable for welded connection.

Bridging sleeve over mechanical coupling.

Factory-connected anode.

Tracer wire connection.

Ultraviolet shield.

Stake supports with factory finish to match steel pipe casing or carrier pipe.

Verify acceptability of couplings in first subparagraph below with authorities having jurisdiction before retaining.

Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Lyall, R. W. & Company, Inc.

Mueller Co.

Perfection Corporation.

Approved equivalent.

PE body with molded-in, stainless-steel support ring.

Buna-nitrile seals.

Acetal collets.

Electro-zinc-plated steel stiffener.

Verify acceptability of couplings in first subparagraph below with authorities having jurisdiction before retaining.

Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Lyall, R. W. & Company, Inc.

Mueller Co.

Perfection Corporation.

Approved equivalent.

Fiber-reinforced plastic body.

PE body tube.

Buna-nitrile seals.

Acetal collets.

Stainless-steel bolts, nuts, and washers.

Couplings in first subparagraph below are available in NPS 1 (DN 25) and larger. Verify acceptability of couplings below with authorities having jurisdiction before retaining.

Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Baker Hughes Company.

Smith-Blair, Inc.

Victaulic

Approved equivalent.

[**Stainless-steel] [Steel**] flanges and tube with epoxy finish.

Buna-nitrile seals.

[**Stainless-steel] [Steel**] bolts, washers, and nuts.

Factory-installed anode for steel-body couplings installed underground.

* + - 1. PIPING SPECIALTIES
				1. Flexible Piping Joints:

Approved for LPG service.

Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.

Minimum working pressure of 250 psig and 250 deg F operating temperature.

Flanged- or threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch misalignment.

Maximum 36-inch length for liquid LPG lines.

Detail flexible connectors on Drawings for specific gas appliances.

* + - * 1. Appliance Flexible Connectors:

Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.

Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.

Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.

Corrugated stainless-steel tubing with polymer coating.

Operating-Pressure Rating: 0.5 psig.

End Fittings: Zinc-coated steel.

Threaded Ends: Comply with ASME B1.20.1.

Maximum Length: 72 inches

Detail quick-disconnect devices on Drawings for specific gas appliances.

* + - * 1. Quick-Disconnect Devices: Comply with ANSI Z21.41.

Copper-alloy convenience outlet and matching plug connector.

Nitrile seals.

Hand operated with automatic shutoff when disconnected.

For indoor or outdoor applications.

Adjustable, retractable restraining cable.

Retain one or more of first three paragraphs below. If retaining more than one type, indicate location of each type on Drawings.

* + - * 1. Y-Pattern Strainers:

Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.

End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

Strainer Screen: [**40] [60**]-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.

CWP Rating: 125 psig.

* + - * 1. Basket Strainers:

Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

Strainer Screen: [**40] [60**]-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.

CWP Rating: 125 psig.

* + - * 1. T-Pattern Strainers:

Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.

End Connections: Grooved ends.

Strainer Screen: [**40] [60**]-mesh startup strainer and perforated stainless-steel basket with 57 percent free area.

CWP Rating: 750 psig.

* + - * 1. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
			1. JOINING MATERIALS
				1. Joint Compound and Tape: Suitable for LPG.
				2. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
				3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8.
			2. MANUAL GAS SHUTOFF VALVES

Coordinate valve materials in this article with "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles. See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to edit this Section.

Shutoff valves for LPG service must comply with one or more standards. Revise this article if compliance with specific standards apply. If locking devices are required, verify that they are available from listed manufacturers.

* + - * 1. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
				2. Metallic Valves, NPS 2 and Smaller for Liquid Service: Comply with ASME B16.33 and UL 842.

CWP Rating: [**250 psig] <Insert pressure**>.

Threaded Ends: Comply with ASME B1.20.1.

Socket ends for brazed joints.

Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Listing by CSA or agency acceptable to authorities having jurisdiction for valves 1 inch and smaller.

Valves 1-1/4 inch and larger shall be suitable for LPG service, with "WOG" indicated on valve body.

* + - * 1. General Requirements for Metallic Valves, NPS 2 and Smaller for Vapor Service: Comply with ASME B16.33.

CWP Rating: [**125 psig] <Insert pressure**>.

Threaded Ends: Comply with ASME B1.20.1.

Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

Service Mark: Valves 1-1/4 inch to NPS 2 shall have initials "WOG" permanently marked on valve body.

* + - * 1. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

CWP Rating: [**125 psig] <Insert pressure**>.

Flanged Ends: Comply with ASME B16.5 for steel flanges.

Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Service Mark: Initials "WOG" shall be permanently marked on valve body.

Caution: Two-piece ball valves with a full or regular port are recommended for most services. One-piece ball valves have a reduced port but one fewer leak paths.

* + - * 1. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Apollo Valves; a part of Aalberts Integrated Piping Systems.

BrassCraft Manufacturing Co.; a Masco company.

Lyall, R. W. & Company, Inc.

Perfection Corporation.

Approved equivalent.

Body: Bronze, complying with ASTM B584.

Ball: Chrome-plated brass.

Stem: Bronze; blowout proof.

Seats: Reinforced TFE; blowout proof.

Packing: Separate packnut with adjustable-stem packing threaded ends.

Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

CWP Rating: 600 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

Where pressure drop is a concern, use full-port ball valves. For corrosive or high-temperature applications, use stainless-steel trim ball valves.

* + - * 1. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Apollo Valves; a part of Aalberts Integrated Piping Systems.

BrassCraft Manufacturing Co.; a Masco company.

Lyall, R. W. & Company, Inc.

Perfection Corporation.

Approved equivalent.

Body: Bronze, complying with ASTM B584.

Ball: Chrome-plated bronze.

Stem: Bronze; blowout proof.

Seats: Reinforced TFE; blowout proof.

Packing: Threaded-body packnut design with adjustable-stem packing.

Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

CWP Rating: 600 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

* + - * 1. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Apollo Valves; a part of Aalberts Integrated Piping Systems.

BrassCraft Manufacturing Co.; a Masco company.

Lyall, R. W. & Company, Inc.

Perfection Corporation.

Approved equivalent.

Body: Bronze, complying with ASTM B584.

Ball: Chrome-plated bronze

Stem: Bronze; blowout proof.

Seats: Reinforced TFE.

Packing: Threaded-body packnut design with adjustable-stem packing.

Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

CWP Rating: 600 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

* + - * 1. Bronze Plug Valves: MSS SP-78.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Lee Brass Company.

McDonald

Approved equivalent.

Body: Bronze, complying with ASTM B584.

Plug: Bronze.

Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Operator: Square head or lug type with tamperproof feature where indicated.

Pressure Class: 125 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

* + - * 1. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Mueller Co.

Xomox Corporation.

Approved equivalent.

Body: Cast iron, complying with ASTM A126, Class B.

Plug: Bronze or nickel-plated cast iron.

Seat: Coated with thermoplastic.

Stem Seal: Compatible with LPG.

Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Operator: Square head or lug type with tamperproof feature where indicated.

Pressure Class: 125 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

* + - * 1. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Flowserve Corporation.

Homestead Valve, a division of Olson Technologies, Inc.

Milliken Valve Company; a Mueller brand.

Mueller Co.

R & M Energy Systems; Robbins & Myers.

Approved equivalent.

Body: Cast iron, complying with ASTM A126 Class B.

Plug: Bronze or nickel-plated cast iron.

Seat: Coated with thermoplastic.

Stem Seal: Compatible with LPG.

Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

Operator: Square head or lug type with tamperproof feature where indicated.

Pressure Class: 125 psig.

Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Service: Suitable for LPG service with "WOG" indicated on valve body.

* + - * 1. PE Ball Valves: Comply with ASME B16.40.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Kerotest Manufacturing Corp.

Lyall, R. W. & Company, Inc.

Perfection Corporation.

Approved equivalent.

Body: PE.

Ball: PE.

Stem: Acetal.

Seats and Seals: Nitrile.

Ends: Plain or fusible to match piping.

CWP Rating: [**80 psig] <Insert pressure**>.

Operating Temperature: [**Minus 20 to plus 140 deg F] <Insert temperature range**>.

Operator: Nut or flat head for key operation.

Include plastic valve extension.

Include tamperproof locking feature for valves where indicated on Drawings.

* + - * 1. Valve Boxes:

Cast-iron, two-section box.

Top section with cover with "GAS" lettering.

Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.

Adjustable cast-iron extensions of length required for depth of bury.

Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head and with stem of length required to operate valve.

* + - 1. MOTORIZED GAS VALVES
				1. Hydrostatic Relief Valves: Comply with NFPA 58.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Engineered Controls International, Inc.

Fischer; Emerson Electric Co., Automation Solutions.

Murray Equipment, Inc.

Sherwood.

Approved equivalent.

Operating Pressure: [**350 psig] <Insert pressure**>.

Body: Brass.

Spring: Stainless steel.

Disc and Seat: Nitrile.

Brass body and stainless-steel, spring-operated valve with resilient rubber disc seat and protective cap.

Factory set and tested.

Listing: Valves listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Valve shall reseat after relieving pressure.

Valves in first paragraph below are used in LPG piping for automatic shutoff service when interlocked with a hazard-condition initiating device. Retain type of operation.

* + - * 1. Automatic Gas Valves: Comply with ANSI Z21.21.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

ASCO; Emerson Electric Co., Automation Solutions.

Dungs, Karl, Inc.

Eaton.

Eclipse Innovative Thermal Technologies.

Honeywell Building Solutions; Honeywell International, Inc.

Johnson Controls.

Approved equivalent.

Body: Brass or aluminum.

Seats and Disc: Nitrile rubber.

Springs and Valve Trim: Stainless steel.

Normally closed.

Visual position indicator.

[**Electrical] [Mechanical**] operator for actuation by appliance automatic shutoff device.

Valves in paragraph below are solenoid type and are used in LPG piping for automatic shutoff service when interlocked with a hazard-condition initiating device.

* + - * 1. Electrically Operated Valves: Comply with UL 429.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

ASCO; Emerson Electric Co., Automation Solutions.

Dungs, Karl, Inc.

Eclipse Innovative Thermal Technologies.

Goyen Valve Corp.

Magnatrol Valve Corporation.

Parker Hannifin Corporation.

WATTS.

Approved equivalent.

Pilot operated.

Body: Brass or aluminum.

Seats and Disc: Nitrile rubber.

Springs and Valve Trim: Stainless steel.

120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.

NEMA ICS 6, Type 4, coil enclosure.

Normally closed.

Visual position indicator.

* + - 1. EARTHQUAKE VALVES

Retain one of two "Earthquake Valves" paragraphs below.

* + - * 1. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE 25.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

ASCO Valve, Inc.

Vanguard Valves, Inc.

Fire Fighter Gas Safety Products

Approved equivalent.

Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Maximum Operating Pressure: 5 psig.

Cast-aluminum body with nickel-plated chrome steel internal parts.

Nitrile-rubber valve washer.

Sight windows for visual indication of valve position.

Threaded-end connections complying with ASME B1.20.1.

* + - * 1. Earthquake Valves, Maximum Operating Pressure of 60 psig: Comply with ASCE 25.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Pacific Seismic Products, Inc.

Thomas, a Xometry Company

Valtorc International

Approved equivalent.

Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.

Maximum Operating Pressure: [**0.5 psig] [7 psig] [60 psig**].

Cast-aluminum body with stainless-steel internal parts.

Nitrile-rubber, reset-stem o-ring seal.

Valve position, open or closed, indicator.

Composition valve seat with clapper held by spring or magnet locking mechanism.

Level indicator.

End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

* + - 1. PRESSURE REGULATORS
				1. General Requirements:

Single stage and suitable for LPG.

Steel jacket and corrosion-resistant components.

Elevation compensator.

End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

Service pressure regulators in first paragraph below are usually provided by LPG supplier. Retain paragraph to require Contactor to provide service regulators.

* + - * 1. Service Pressure Regulators: Comply with ANSI Z21.80.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Actaris.

American Meter Company.

Fischer; Emerson Electric Co., Automation Solutions.

Invensys.

Itron Gas.

Richards Industries.

Approved equivalent.

Body and Diaphragm Case: Cast iron or die-cast aluminum.

Springs: Zinc-plated steel; interchangeable.

Diaphragm Plate: Zinc-plated steel.

Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

Orifice: Aluminum; interchangeable.

Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.

Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.

Overpressure protection device is optional feature. See Evaluations.

Overpressure Protection Device: Factory mounted on pressure regulator.

Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

Maximum Inlet Pressure: **[100 psig] <Insert pressure**>.

* + - * 1. Line Pressure Regulators: Comply with ANSI Z21.80.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Actaris.

American Meter Company.

Eclipse Innovative Thermal Technologies.

Fischer; Emerson Electric Co., Automation Solutions.

Invensys.

Itron Gas.

Maxitrol Company.

Richards Industries.

Approved equivalent.

Body and Diaphragm Case: Cast iron or die-cast aluminum.

Springs: Zinc-plated steel; interchangeable.

Diaphragm Plate: Zinc-plated steel.

Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

Orifice: Aluminum; interchangeable.

Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.

Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.

Overpressure protection device is optional feature. See Evaluations.

Overpressure Protection Device: Factory mounted on pressure regulator.

Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

Maximum Inlet Pressure: [**2 psig] [5 psig] [10 psig] <Insert pressure**>.

* + - * 1. Appliance Pressure Regulators: Comply with ANSI Z21.18.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Canadian Meter Company Inc.

Eaton.

Harper Wyman Co.

Maxitrol Company.

SCP, Inc.

Approved equivalent.

Body and Diaphragm Case: Die-cast aluminum.

Springs: Zinc-plated steel; interchangeable.

Diaphragm Plate: Zinc-plated steel.

Seat Disc: Nitrile rubber.

Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.

Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

Maximum Inlet Pressure: **[1 psig] [2 psig] [5 psig] <Insert pressure>**.

* + - 1. SERVICE METERS

Meter bars or other supports and service meters are usually provided by LPG supplier. Retain this article if Contractor provides meters.

In first paragraph below, retain first option for units having capacities of 500 cfh (3935 mL/s) and less and second for units having capacities more than 500 cfh (3935 mL/s).

* + - * 1. Diaphragm-Type Service Meters: Comply with [**ANSI B109.1] [ANSI B109.2**].

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Actaris.

American Meter Company.

Invensys.

Itron Gas.

Approved equivalent.

Case: Die-cast aluminum.

Connections: Steel threads.

Diaphragm: Synthetic fabric.

Diaphragm Support Bearings: Self-lubricating.

Pressure compensation is available, but is not usually required.

Compensation: Continuous temperature[ **and pressure**].

Meter Index: [**Cubic feet] [Liters] [Cubic feet and liters**].

Meter Case and Index: Tamper resistant.

Remote meter reader compatible.

Maximum Inlet Pressure: [**100 psig] <Insert pressure**>.

Pressure Loss: Maximum [**0.5-inch wg] [2.0-inch wg] <Insert pressure differential**>.

Accuracy: Maximum plus or minus [**1.0] <Insert number**> percent.

* + - * 1. Rotary-Type Service Meters: Comply with ANSI B109.3.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

American Meter Company.

Invensys.

Romet Ltd.

Approved equivalent.

Case: Extruded aluminum.

Connection: Flange.

Impellers: Polished aluminum.

Rotor Bearings: Self-lubricating.

Pressure compensation is available, but is not usually required.

Compensation: Continuous temperature[ **and pressure**].

Meter Index: [**Cubic feet] [Liters] [Cubic feet and liters**].

Tamper resistant.

Remote meter reader compatible.

Maximum Inlet Pressure: [**100 psig] <Insert pressure**>.

Accuracy: Maximum plus or minus **[2.0] <Insert number**> percent.

* + - * 1. Turbine Meters: Comply with ASME MFC-4M.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

American Meter Company.

Invensys.

Turbines Inc.

Approved equivalent.

Housing: Cast iron or welded steel.

Connection Threads or Flanges: Steel.

Turbine: Aluminum or plastic.

Turbine Bearings: Self-lubricating.

Pressure compensation is available, but is not usually required.

Compensation: Continuous temperature[ **and pressure**].

Meter Index: [**Cubic feet] [Liters] [Cubic feet and liters**].

Tamper resistant.

Remote meter reader compatible.

Maximum Inlet Pressure: [**100 psig] <Insert pressure**>.

Accuracy: Maximum plus or minus [**2.0] <Insert number**> percent.

Service-meter bars in first paragraph below are normally limited to NPS 1 (DN 25).

* + - * 1. Service-Meter Bars:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Actaris.

American Meter Company.

Itron Gas.

Lyall, R. W. & Company, Inc.

Mueller Co.

Perfection Corporation.

Approved equivalent.

Malleable- or cast-iron frame for supporting service meter.

Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.

Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

Retain paragraph below if permitted by utility and authorities having jurisdiction.

* + - * 1. Service-Meter Bypass Fittings:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Lyall, R. W. & Company, Inc.

Williamson, T. D., Inc.

A.Y. McDonald Mfg. Co.

Approved equivalent.

Ferrous, tee, pipe fitting with capped side inlet for temporary LPG supply.

Integral ball-check bypass valve.

* + - 1. DIELECTRIC FITTINGS
				1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

Unions in first paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

* + - * 1. Dielectric Unions:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

A.Y. McDonald Mfg. Co.

Capitol Manufacturing Company.

Central Plastics Company.

HART Industrial Unions, LLC.

Jomar Valve.

Matco-Norca.

WATTS.

Wilkins.

Approved equivalent.

Description:

Standard: ASSE 1079.

Revise pressure rating and temperature in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**125 psig minimum at 180 deg F] [150 psig] [250 psig**].

End Connections: Solder-joint copper alloy and threaded ferrous.

Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4 (DN 40 to DN 100).

* + - * 1. Dielectric Flanges:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Capitol Manufacturing Company.

Central Plastics Company.

Matco-Norca.

WATTS.

Wilkins.

Approved equivalent.

Description:

Standard: ASSE 1079.

Factory-fabricated, bolted, companion-flange assembly.

Revise pressure rating in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**125 psig minimum at 180 deg F] [150 psig] [175 psig] [300 psig**].

End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

Flanges in paragraph below are available in at least NPS 1/2 to NPS 48 (DN 15 to DN 1200).

* + - * 1. Dielectric-Flange Insulating Kits:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Advance Products & Systems, Inc.

Calpico, Inc.

Central Plastics Company.

Pipeline Seal and Insulator, Inc.

Approved equivalent.

Description:

Nonconducting materials for field assembly of companion flanges.

Revise pressure rating in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**150 psig] <Insert pressure**>.

Gasket: Neoprene or phenolic.

Bolt Sleeves: Phenolic or polyethylene.

Washers: Phenolic with steel backing washers.

* + - 1. STORAGE CONTAINERS
				1. Description: Factory fabricated, complying with requirements in NFPA 58 and ASME Boiler and Pressure Vessel Code and bearing the ASME label. Tanks shall be rated for 250-psig minimum working pressure.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

American Welding & Tank.

Roy E. Hanson Jr. Mfg.

Trinity Industries, Inc.

United Industries Group, Inc.

Approved equivalent.

Liquid outlet and vapor inlet and outlet connections shall have shutoff valves with excess-flow safety shutoff valves and bypass and back-pressure check valves with smaller than 0.039-inch drill-size hole to equalize pressure. Liquid-fill connection shall have backflow check valve.

Connections: Color-code and tag valves to indicate type.

Liquid fill and outlet, red.

Vapor inlet and outlet, yellow.

Level gage shall indicate current level of liquid in the container. Gages shall also indicate storage container contents; e.g., "Butane," "50-50 LPG Mix," or "Propane."

Pressure relief valves, type and number as required by NFPA 58, connected to vapor space and having discharge piping same size as relief-valve outlet and long enough to extend at least 84 inches directly overhead. Identify relief valves as follows:

Discharge pressure in psig.

Rate of discharge for standard air in cfm.

Manufacturer's name.

Catalog or model number.

Container pressure gage.

For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.

Ladders for access to valves more than 72 inches aboveground.

Stainless-Steel Nameplate: Attach to aboveground storage container or to adjacent structure for underground storage container.

Retain both IP and SI units of measure in first 11 subparagraphs below because NFPA 58 requires both IP and SI units of measure on labels.

Name and address of supplier or trade name of container.

Water capacity in gallons and liters.

Design pressure in psig (kPa).

Consult with container manufacturer for maximum pressure to insert in first subparagraph below.

Statement, "This container shall not contain a product having a vapor pressure in excess of <**Insert maximum pressure in psig at 100 deg F**>."

Outside surface area in sq. ft. (sq. m).

Year of manufacture.

Shell thickness in inches (mm).

Overall length in feet (m).

OD in feet (m).

Manufacturer's serial number.

ASME Code label.

Retain first subparagraph below for aboveground storage containers.

Felt support pads and two concrete or painted-steel saddles per storage container. Corrosion protection required at container-to-felt contact.

Retain first subparagraph below for aboveground storage containers in seismic Project sites.

Tie straps for each saddle.

Retain four subparagraphs below for underground storage containers.

Straps and anchors for tie-down slab.

Asphalt-based coating for corrosion protection.

Container connections and valves protected in manway at top of storage container.

Manway equipped with ventilation louvers.

* + - 1. TRANSPORT TRUCK UNLOADING FACILITY
				1. Description: Comply with requirements in NFPA 58.

Support structure consisting of a minimum 6-inch steel channel or 6-by-4-inch rectangular steel tubing, a minimum of 36 inches above and below grade.

Liquid-fill and vapor-return, quick-disconnect fittings.

Liquid and vapor shutoff valves with hydrostatic relief valves mounted between the quick-disconnect fittings and shutoff valves.

Excess-flow safety shutoff valve in vapor-return line.

Backflow check valve in liquid-fill line.

Remote emergency shutoff valve station with underground cable to the vapor emergency shutoff valve.

* + - 1. PUMPS
				1. Description: Factory-assembled and -tested, duplex, positive-displacement, belt drive.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Blackmer; PSG, a Dover company.

Corken, Inc.; a unit of IDEX Corporation.

Jaeco Fluid Systems Inc.

Approved equivalent.

* + - * 1. Pump Construction:

Casing: Ductile-iron casing with threaded gage tappings at inlet and outlet.

Internal Pressure Relief Valve: For pump protection in addition to the external pressure relief valves.

Impeller: Carbon or composite vane in cast-iron rotor.

Pump Shaft: Carbon steel.

Seal: Mechanical with Buna-N o-ring.

Pump Bearings: Ball bearings with grease fittings.

Baseplate: Bent carbon-steel channel or structural channel.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Motor Speeds: Single.

Retain first option in first subparagraph below for motors 5 hp and smaller, second option for motors larger than 5 hp.

Bearings: [**Permanently lubricated] [Grease-lubricated**] ball bearings.

Class I, Division 1, Group D requirements per NFPA 70.

* + - * 1. Factory-Installed Piping and Specialties:

Pipe: ASTM A53, Type E or S, Grade B; Schedule 40 black steel with welded fittings and joints or Schedule 80 for threaded malleable-iron fittings and joints.

Piping Specialties for Each Pump:

Bypass valve.

Isolation valves.

Unions for each connection.

Check valve.

Basket strainer.

Pressure gages for suction and discharge connections.

Hydrostatic relief valve.

Pilot-operated, pressure-regulating valve.

* + - * 1. Braided-jacket flexible connectors for suction and discharge connections.
				2. Pump and Piping Finish: For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
				3. Controls:

Explosion-proof controls enclosure.

Magnetic starter package with automatic alternator.

Pressure-activated start and stop.

Lag pump starts if lead pump fails.

Audible and visual indication of pump failure.

Retain option in paragraph below if tank has multiple, equal-size pumps. If Project has more than one tank and pump configuration, delete paragraph and schedule pumps on Drawings.

* + - * 1. Capacities and Characteristics**[ for Each Pump**]:

Capacity: <**Insert gph**>.

Minimum Working Pressure: [**350 psig] <Insert pressure**>.

Continuous Fluid Temperature: [**250 deg F] <Insert temperature**>.

Total Dynamic Head: <**Insert psig**>.

Inlet and Outlet Size: <**Insert NPS**>.

Return Size: <**Insert NPS**>.

Pump Speed: <**Insert rpm**>.

Motor Speed: <**Insert rpm**>.

Motor Horsepower: <**Insert value**>.

Electrical Characteristics:

Volts: [**240] [480] <Insert value**>.

Phase: **[Single] [Three**].

Hertz: 60.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. VAPORIZERS
				1. Description: Factory-fabricated, -assembled, and -tested vaporizer with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket, flue-gas vent, liquid fuel supply and vapor connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Algas-SDI.

Alternate Energy Systems, Inc.

Ely Energy, Inc.

Ransome Manufacturing; a division of Meeder Equipment Company.

Approved equivalent.

Retain first paragraph below for projects in seismic areas. Coordinate with "Performance Requirements" and submittals articles.

* + - * 1. Fabricate base and attachment to vaporizers with reinforcement strong enough to resist vaporizer movement during a seismic event when steel base is anchored to a concrete base.
				2. Casing:

Mineral-fiber insulation, a minimum of 2 inches thick, surrounding the heat exchanger.

Integral one-piece skid with forklift access holes.

Lifting lugs on top of vaporizer.

Retain first subparagraph below for indirect-type vaporizers.

Flue rain cap and bird screen.

Sheet metal jacket with screw-fastened closures and [**baked-enamel] [powder-coat**] protective finish.

Mounting base to secure boiler to concrete base.

Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels for LPG-fired vaporizers. Explosion-proof control compartment construction required for electric vaporizers.

* + - * 1. LPG Liquid and Vapor Circuit Specialties:

Y-type strainer with drain valve at inlet.

Vaporizer coil safety pressure relief valve.

Vaporizer coil blowdown valve.

Vapor outlet isolation valve.

Pressure gages, a minimum of 2-1/2 inches in diameter, at liquid inlet and vapor discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.

Retain first three subparagraphs below for water-bath vaporizers or direct-fired electric vaporizers.

Inlet safety solenoid valve to close with off-normal operation alarm.

Backflow check valve in bypass around inlet safety solenoid valve.

Liquid carryover or float-type safety shutoff switch.

Retain device in subparagraph below if required to clean the fuel.

LPG Vapor Filter: Steel shell designed and manufactured per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; factory mounted on vaporizer discharge. Shells larger than 5 inches shall be ASME "U" stamped. Fill with stainless-steel, woven-mesh coalescing element to remove 99 percent of particles larger than 10 microns. 250-psig minimum working pressure. Finish with corrosion-resistant coating for an exterior application. Include factory-mounted and -piped, differential pressure gage with gage cocks in and out, and minimum NPS 3/4 full-port, ball-type drain valve.

Retain first paragraph below for direct-type, direct-fired vaporizers where heating energy is furnished from stored gas such as propane or butane. This vaporizer heats the liquid fuel directly. Heat from the burner is applied directly to the heat exchanger containing liquid LPG to vaporize the fuel.

* + - * 1. Direct-Type, Direct-Fired Heat Exchanger:

Description: ASME-rated and -stamped, LPG, vaporizer coil contained in an enclosure insulated with at least 2-inch- thick, mineral-fiber board enclosure with a burner.

Burner Tubes and Orifices: Stainless steel.

Gas Train: Control devices and burner control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.

Pilot: Standing pilot with 100 percent main-valve and pilot safety shutoff.

Burner Operating Controls:

Controls shall maintain safe operating conditions. Mechanical burner safety controls limit operation of the burner.

High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.

Operating Vapor-Pressure Control: Factory piped and mounted to control burner.

Retain first paragraph below for indirect-type, direct-fired vaporizers where heating energy is furnished by an immersion-type, electric heating element that applies heat directly to a liquid-filled pressure vessel to vaporize the fuel.

* + - * 1. Indirect-Type, Direct-Fired Heat Exchanger:

Description: ASME-rated and -stamped, LPG, vaporizer vessel with a replaceable, immersion-type, electric heating element.

Heating Element Operating Controls:

Operating controls shall maintain safe operating conditions. Safety controls limit operation of the element.[ **Microprocessor-based control system integrates safety and operating controls.]**

Operating Vapor-Pressure Control: Factory wired and mounted to control heating element.

High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.

Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.

Control Transformer: 115-V maximum control voltage.

Retain first paragraph below for direct-type, water-bath vaporizers where heating energy is furnished from stored gas such as propane or butane. This vaporizer heats the liquid fuel indirectly. Heat from a burner is applied to a water/glycol solution that circulates through a heat exchanger containing liquid LPG to vaporize the fuel.

* + - * 1. Direct-Type, Water-Bath Heat Exchanger:

Description: Straight, steel fire tubes welded into steel headers with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:

Water bath filled with water/glycol solution designed to prevent freezing at [**minus 30 deg F] <Insert temperature**>.

Water-bath, high- and low-level sight glasses.

Low-water cutoff to stop burner and annunciate alarm.

Water/glycol fill and vent fitting.

Minimum NPS 3/4 hose-end drain valves.

Operating high- and low-limit aqua stat controllers.

Water-bath temperature gage; a minimum of 2-1/2 inches in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.

Burner Tubes and Orifices: Stainless steel.

Gas Train: Control devices and burner modulation control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.

Pilot: [**Intermittent-electric-spark] [Hot-surface**] pilot ignition with 100 percent main-valve and pilot safety shutoff with electronic supervision of burner flame.

Burner Operating Controls:

Operating controls shall maintain safe operating conditions. Safety controls limit operation of the burner.[ **Microprocessor-based control system integrates safety and operating controls.**]

Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.

High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or vapor pressure.

Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.

Control Transformer: 115-V maximum control voltage.

Retain first paragraph below for indirect-type, water-bath vaporizers where heating energy is furnished by an immersion-type, electric heating element that applies heat to a water/glycol solution that circulates through LPG liquid-filled heat exchanger to vaporize the fuel.

* + - * 1. Indirect-Type, Water-Bath Heat Exchanger:

Description: Immersion-type, electric heating element with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:

Water bath filled with water/glycol solution designed to prevent freezing at [**minus 30 deg F] <Insert temperature**>.

Water-bath, high- and low-level sight glasses.

Low-water cutoff to stop electric heater and annunciate alarm.

Water/glycol fill and vent fitting.

Minimum NPS 3/4 hose-end drain valves.

Operating high- and low-limit aqua stat controllers.

Water-bath temperature gage; a minimum of 2-1/2 inches in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.

Electric Heater Operating Controls:

Controls shall maintain safe operating conditions. Safety controls limit operation of the electric element.[ **Microprocessor-based control system integrates safety and operating controls.**]

Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.

High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or pressure.

Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.

Control Transformer: 115-V maximum control voltage.

Retain first paragraph below if vaporizer controls interface with building management system.

* + - * 1. Building Management System Interface: Factory-installed hardware and software to enable building management system to monitor and control set points and display vaporizer status and alarms.

If Project has more than one type or configuration of vaporizer, delete paragraph below and schedule vaporizers on Drawings.

* + - * 1. Capacities and Characteristics:

Heating Fuel: [**Propane] [Butane] [Electric**].

Vaporization Heat Exchanger:

Minimum Working-Pressure Rating: [**250 psig] <Insert value**>.

Test Pressure: [**375 psig] <Insert value**>.

LPG Vaporization Rate: <**Insert gph**>.

Values in first three subparagraphs below are for propane. If butane is specified, insert proper values obtained from fuel supplier.

Entering-LPG Temperature: [**Minus 30 deg F] <Insert temperature**>.

Leaving-LPG Temperature: [**80 deg F] <Insert temperature**>.

Discharge-LPG Pressure: [**90 psig] <Insert value**>.

LPG input is part of vaporization rate for direct-type vaporizers.

Burner Gas Input: <**Insert Btu/h**>.

Retain first subparagraph below for electric vaporizers.

Electric Burner Input: <**Insert kilowatts**>.

Retain first two subparagraphs below for water-bath vaporizers.

Water-Bath Shell Operating Pressure: [**Atmospheric] <Insert psig**>.

Water-Bath Operating Temperature: [**160 deg F] <Insert temperature**>.

Electrical Characteristics:

Volts: [**120] [240] [480] <Insert value**>.

Phase: [**Single] [Three**].

Hertz: 60.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. AIR MIXERS

Retain option in first paragraph below only if outlet pressure higher than 12 psig (82.7 kPa) is required.

* + - * 1. Description: Factory-fabricated, -assembled, -calibrated, and -tested[, blower-assisted] air mixer with surge tank, built on a steel base; including vapor supply and discharge connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Algas-SDI.

Alternate Energy Systems, Inc.

Ely Energy, Inc.

Ransome Manufacturing; a division of Meeder Equipment Company.

Approved equivalent.

Retain first paragraph below for projects in seismic areas. Coordinate with "Performance Requirements" and submittals articles.

* + - * 1. Fabricate base and attachment to mixers with reinforcement strong enough to resist air mixer movement during a seismic event when steel base is anchored to a concrete base.
				2. Mounting Skid, Panels, and Surge Tank:

Integral one-piece skid with forklift access holes.

Lifting lugs on top of air mixer.

[**Baked-enamel] [Powder-coat**] protective finish.

Mounting base to secure boiler to concrete base.

Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels.

ASME-stamped surge tank with venturi, isolation valves, excess-flow safeties, and safety relief valves.

Retain first paragraph below only if outlet pressure between 12 and 20 psig (82.7 and 138 kPa) is required.

* + - * 1. Blower: Positive-displacement, rotary-lobe type.

Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." Permanently lubricated ball bearings are available for motors up through 5 hp. Larger motors have grease-lubricated ball bearings.

Motor: Single speed, with [**permanently lubricated] [grease-lubricated**] ball bearings. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. LPG Circuit Specialties:

Venturi solenoid valves.

Venturi nozzles, minimum of 3, for minimum of 10:1 turndown capacity.

Venturi silencers are not available on blower-type units.

Venturi silencers.

Retain first subparagraph below for LPG containing particulates.

Mist filter and strainer with pressure differential gage, and blowdown ball valve.

Inlet and outlet isolation valves.

Pressure gages, a minimum of 2-1/2 inches in diameter, at inlet and discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.

* + - * 1. Air-Mixer Controls:

Controls shall maintain safe operating conditions. The following safety controls limit the operation of the air mixer. All safety controls are manual reset.

Low-inlet-vapor pressure.

High- or low-discharge pressure.

Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.

Control Transformer: 115-V maximum control voltage.

Retain first paragraph below if both vaporizer and air mixer are required.

* + - * 1. Mount on common skid with vaporizer.

If Project has more than one type or configuration of air mixer, delete paragraph below and schedule air mixers on Drawings.

* + - * 1. Capacities and Characteristics:

Heating Fuel: [**Propane] [Butane**].

Air Mixer:

Outlet Pressure: [**20 psig] <Insert value**>.

Test Pressure: [**30 psig] <Insert value**>.

Entering LPG:

Values in options in first two subparagraphs below are typical for propane. If butane is specified, insert proper values obtained from fuel supplier.

Temperature: [**90 deg F] <Insert temperature**>.

Inlet Pressure: [**20 psig] <Insert value**>.

Mixed Gas:

Values in options in first four subparagraphs below are typical for propane. If butane is specified, insert proper values obtained from fuel supplier.

Pressure: [**20 psig] <Insert value**>.

Higher Heating Value: [**1430 Btu/cu. ft.] <Insert value**>.

Specific Gravity: **[1.3] <Insert value**>.

Flow Rate: <**Insert gph**>.

Electrical Characteristics:

Volts: [**120] [240] [480] <Insert value**>.

Phase: [**Single] [Three**].

Hertz: 60.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. LABELING AND IDENTIFYING
				1. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine roughing-in for LPG piping system to verify actual locations of piping connections before equipment installation.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. PREPARATION

Retain first paragraph below for renovation and addition projects.

* + - * 1. Close equipment shutoff valves before turning off LPG to premises or piping section.
				2. Inspect LPG piping according to NFPA 58 and [**NFPA 54] [the International Fuel Gas Code**] to determine that LPG utilization devices are turned off in piping section affected.
				3. Comply with NFPA 58 and [**NFPA 54] [the International Fuel Gas Code**] requirements for prevention of accidental ignition.
			1. OUTDOOR PIPING INSTALLATION
				1. Comply with NFPA 58 and [**NFPA 54] [the International Fuel Gas Code**] requirements for installation and purging of LPG piping.

NFPA 54 requires a minimum of 18 inches of cover over buried LPG piping, or 12 inches with shielding. Pipe with less than 12 inches of cover must be installed in a containment conduit.

* + - * 1. Install underground, LPG piping buried at least [**36 inches] <Insert dimension**> below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

If LPG piping is installed less than 36 inches below finished grade, install it in containment conduit.

* + - * 1. Install underground, PE, LPG piping according to ASTM D2774.
				2. Steel Piping with Protective Coating:

Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

Retain one of two subparagraphs below. Verify acceptability of repaired coating systems with authorities having jurisdiction.

Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

Replace pipe having damaged PE coating with new pipe.

CSA B149.1 requires protective coating for Type G and Type L (Type B) copper pipe and tube installed underground.

* + - * 1. Copper Tubing with Protective Coating:

Retain both subparagraphs below for copper tubing protected from corrosion by PE coating.

Apply joint cover kits over tubing to cover, seal, and protect joints.

Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

* + - * 1. Install fittings for changes in direction and branch connections.
				2. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.
				3. Install pressure gage [**downstream] [upstream and downstream**] from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
			1. INDOOR PIPING INSTALLATION
				1. Comply with [**NFPA 54] [the International Fuel Gas Code**] for installation and purging of LPG piping.
				2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
				3. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
				4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
				5. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
				6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
				7. Locate valves for easy access.

Retain first paragraph below for other than dry gas.

* + - * 1. Install LPG piping at uniform grade of 2 percent down toward drip and sediment traps.
				2. Install piping free of sags and bends.
				3. Install fittings for changes in direction and branch connections.
				4. Verify final equipment locations for roughing-in.
				5. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
				6. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

* + - * 1. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
				2. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
				3. Concealed Location Installations: Except as specified below, install concealed LPG piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

Five subparagraphs below are taken from NFPA 54. Conditions are subject to approval of authorities having jurisdiction.

Above Accessible Ceilings: LPG piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

Underground piping installed below a building must be installed in a containment conduit that is vented to outside.

In Floors: Install LPG piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

Coordinate first subparagraph below with Drawings.

In Floor Channels: Install LPG piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

Exception: Tubing passing through partitions or walls does not require striker barriers.

Prohibited Locations:

Do not install LPG piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

Do not install LPG piping in solid walls or partitions.

* + - * 1. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
				2. Connect branch piping from top or side of horizontal piping.
				3. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
				4. Do not use LPG piping as grounding electrode.
				5. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
				6. Install pressure gage [**downstream] [upstream and downstream**] from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
				7. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

* + - * 1. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
				2. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
			1. SERVICE-METER ASSEMBLY INSTALLATION

Service meters are often installed by utility. Retain this article to require Contractor to install service meter. Install meter assemblies in heated spaces if LPG contains moisture.

* + - * 1. Install service-meter assemblies aboveground[, **on concrete bases**].
				2. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
				3. Install strainer on inlet of service-pressure regulator and meter set.
				4. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
				5. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
				6. Install service meters downstream from pressure regulators.

Revise paragraph below to suit Project and show bollards on Drawings; delete if not required.

* + - * 1. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.
			1. VALVE INSTALLATION
				1. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
				2. Install underground valves with valve boxes.
				3. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
				4. Install earthquake valves aboveground outside buildings according to listing.
				5. Install anode for metallic valves in underground PE piping.
			2. PIPING JOINT CONSTRUCTION
				1. Ream ends of pipes and tubes and remove burrs.
				2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
				3. Threaded Joints:

Thread pipe with tapered pipe threads complying with ASME B1.20.1.

Cut threads full and clean using sharp dies.

Ream threaded pipe ends to remove burrs and restore full ID of pipe.

Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

* + - * 1. Welded Joints:

Construct joints according to AWS D10.12, using qualified processes and welding operators.

Bevel plain ends of steel pipe.

Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

* + - * 1. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."
				2. Flanged Joints: Install gasket material, size, type, and thickness appropriate for LPG service. Install gasket concentrically positioned.
				3. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
				4. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

Plain-End Pipe and Fittings: Use butt fusion.

Plain-End Pipe and Socket Fittings: Use socket fusion.

* + - 1. HANGER AND SUPPORT INSTALLATION

Retain first paragraph below for projects in areas that require seismic restraints.

* + - * 1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
				2. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
				3. Install hangers for [**steel piping] [and] [copper tubing**], with maximum spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				4. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				5. Support horizontal piping within [**12 inches] <Insert dimension**> of each fitting.
				6. Support vertical runs of [**steel piping] [and] [copper tubing**] to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				7. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings. If Drawings are explicit enough, these requirements may be reduced or omitted.

Delete first two paragraphs below if utility makes connection to its gas main, or retain one of two paragraphs and revise to suit Project.

* + - * 1. Connect to utility's gas main according to utility's procedures and requirements.
				2. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
				3. Install piping adjacent to appliances to allow service and maintenance of appliances.
				4. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.
				5. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
			1. TRANSPORT TRUCK UNLOADING FACILITY

Coordinate this article with Drawings.

* + - * 1. Install transport truck unloading in a cast-in-place concrete base, 48 inches square by 36 inches deep. Set top of concrete base at least 6 inches above finished grade.
				2. Install remote emergency shutoff station with cable release in an accessible location, a minimum of 25 feet and a maximum of 100 feet away from transport truck unloading.
				3. Install at least two 6-inch- diameter metal bollards set in and filled with concrete on both sides of transport truck unloading. Bollard length shall be at least 48 inches above and below grade, with concrete encasement a minimum of 12 inches in diameter.
			1. STORAGE CONTAINER INSTALLATION
				1. Fill storage container to at least 80 percent capacity with [**butane] [propane**].
				2. Install piping connections with swing joints or flexible connectors to allow for storage container settlement and for thermal expansion and contraction.
				3. Ground containers according to NFPA 780. Grounding is specified in Section 264113 "Lightning Protection for Structures."

Retain first paragraph below for aboveground storage containers only.

* + - * 1. Set storage containers in felt pads on concrete or steel saddles. Install corrosion protection at container-to-felt contact.

Retain first two paragraphs below for aboveground storage containers where authorities having jurisdiction require in seismic restraint for Project site.

* + - * 1. Install tie-downs over storage containers on saddles with proper tension.
				2. Set concrete saddles on dowels set in concrete base. Anchor steel saddles to concrete base.

Retain five paragraphs below for underground storage containers.

* + - * 1. Set storage container on concrete ballast base large enough to offset buoyancy of empty storage container immersed in water.
				2. Install tie-down straps over container anchored in ballast base and repair damaged coating.
				3. Backfill with a minimum coverage for underground or mounded storage containers according to NFPA 58.
				4. Install cathodic protection for storage container. Cathodic protection is specified in Section 134713 "Cathodic Protection."
			1. PUMP INSTALLATION
				1. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.
				2. Set pumps on and anchored to concrete base.
				3. Install suction piping with minimum fittings and change of direction.
				4. Connect liquid suction to container, supply to vaporizer, and return line to container.
			2. VAPORIZER INSTALLATION
				1. Install vaporizer with access space for periodic maintenance.
				2. Set vaporizers on and anchor to concrete base.
				3. Connect liquid line from pump set, and vapor supply to distribution piping.
				4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass the vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.
			3. AIR MIXER WITH VAPORIZER INSTALLATION

Retain this article if combination air mixer with vaporizer is assembled on common skid.

* + - * 1. Install air mixer with vaporizer with access space for periodic maintenance.
				2. Set air mixer with vaporizer on and anchor to concrete base.
				3. Connect liquid line from pump set, and mixed gas supply to distribution piping.
				4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.
				5. Replace filters at Substantial Completion if air mixer was operated during construction.
			1. LABELING AND IDENTIFYING

Retain one of two paragraphs in this article.

* + - * 1. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
				2. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
			1. PAINTING

Section 099114 "Exterior Painting" and Section 099123 "Interior Painting" specify paint products for various surfaces (e.g., ferrous and nonferrous metals). For HVAC items to be field painted, choose among various application methods and coating systems (number of prime and finish coatings and coating thicknesses). Coordinate these requirements with Architect to ensure that appropriate painting requirements are retained in Section 099114 "Exterior Painting" and Section 099123 "Interior Painting."

* + - * 1. Comply with requirements in Section 099114 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior LPG piping.
				2. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

Alkyd System: MPI EXT 5.1D.

Prime Coat: Alkyd anticorrosive metal primer.

For a Premium Grade system, "MPI Manual" requires intermediate coat; delete intermediate coat for a Custom Grade system.

Intermediate Coat: Exterior alkyd enamel matching topcoat.

Topcoat: Exterior alkyd enamel **[(flat)] [(semigloss)] [(gloss**)].

Color: [**Gray] <Insert color**>.

* + - * 1. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

Retain one of two subparagraphs below.

Latex Over Alkyd Primer System: MPI INT 5.1Q.

Prime Coat: [**Alkyd anticorrosive] [Quick-drying alkyd**] metal primer.

For a Premium Grade system, "MPI Manual" requires intermediate coat; delete intermediate coat for a Custom Grade system.

Intermediate Coat: Interior latex matching topcoat.

Topcoat: Interior latex [(**flat)] [(low sheen)] [(eggshell)] [(satin)] [(semigloss)] [(gloss**)].

Color: [**Gray] <Insert color**>.

Alkyd System: MPI INT 5.1E.

Prime Coat: [**Alkyd anticorrosive] [Quick-drying alkyd**] metal primer.

For a Premium Grade system, "MPI Manual" requires intermediate coat; delete intermediate coat for a Custom Grade system.

Intermediate Coat: Interior alkyd matching topcoat.

Topcoat: Interior alkyd **[(flat)] [(eggshell)] [(semigloss)] [(gloss)**].

Color: [**Gray] <Insert color**>.

* + - * 1. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
			1. CONCRETE BASES

Coordinate concrete work in this article with Section 033000 "Cast-in-Place Concrete."

* + - * 1. Concrete Bases: Anchor equipment to concrete base[ **according to seismic codes at Project**].

Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on [**18-inch] <Insert dimension**> centers around the full perimeter of the base.

Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Use **[3000-psig] <Insert value**>, 28-day, compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

* + - 1. FIELD QUALITY CONTROL
				1. Perform tests and inspections.
				2. Tests and Inspections:

Test, inspect, and purge LPG according to NFPA 58 and [**NFPA 54] [the International Fuel Gas Code**] and requirements of authorities having jurisdiction.

* + - * 1. LPG piping will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. DEMONSTRATION
				1. Engage a Company Service Advisor to train Director’s Representative’s maintenance personnel to adjust, operate, and maintain LPG equipment.
			2. OUTDOOR PIPING SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2. Retain multiple materials for Contractor's option.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground LPG liquid piping shall be[ **one of**] the following:

Schedule 40 steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

Practical size limit for Type K (Type A) copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing. Type L (Type B) copper is limited to maximum NPS 2 (DN 50) for NFPA 58-required 350-psig (2413-kPa) pressure rating for pipe.

[**Annealed] [Drawn**]-temper copper tube, [**Type K] [Type L**] with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground LPG liquid piping shall be[ **one of]** the following:

CSA B149.1 requires Schedule 80, steel pipe and fittings for threaded joints. Authorities having jurisdiction may require threaded joints to be seal welded and may require the break between threaded and welded pipe to occur at a different pipe size.

[**NPS 2] <Insert pipe size**> and Smaller: [**Schedule 40] [Schedule 80**] steel pipe, malleable-iron threaded fittings and threaded[ **and seal welded**] joints. Coat pipe and fittings with protective coating for steel piping.

[**NPS 2-1/2] <Insert pipe size**> and Larger: Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

Practical size limit for Type K (Type A) copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing. Type L (Type B) copper is limited to maximum NPS 2 (DN 50) for NFPA 58-required 350-psig (2413-kPa) pressure rating for pipe.

[**Annealed] [Drawn]**-temper copper tube, Type L with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground LPG vapor piping shall be[ **one of**] the following:

PE pipe is available in NPS 1/2 to NPS 16 (DN 15 to DN 400), maximum NPS 2 (DN 50) in 1000-foot (305-m) rolls.

PE pipe and fittings joined by heat-fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing.

[**Annealed] [Drawn**]-temper copper tube, Type L with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground LPG vapor piping shall be[ **one of**] the following:

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing.

[**Annealed] [Drawn**]-temper copper tube, Type L with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

* + - * 1. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper, with wrought-copper fittings and [**brazed] [flared**] joints. Install piping embedded in concrete with no joints in concrete.

Indicate extent of containment conduit on Drawings. Containment conduit is required for piping with insufficient depth of bury.

* + - * 1. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
			1. INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, branch piping [**NPS 1] <Insert pipe size**> and smaller shall be**[ one of]** the following:

Contact authorities having jurisdiction and verify approval before specifying corrugated stainless-steel tubing.

Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.

Tin-lined tube in first subparagraph below is available in 1/4- to 5/8-inch OD and is equivalent to NPS 1/8 to NPS 1/2 (DN 6 to DN 15).

Annealed-temper, tin-lined copper tube with flared joints and fittings.

Annealed-temper copper tube with wrought-copper fittings and [**brazed] [flared**] joints.

Aluminum tube with flared fittings and joints.

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, distribution piping shall be[ **one of**] the following:

Authorities having jurisdiction may require welded steel pipe at different sizes and pressures.

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with wrought-steel fittings and welded joints.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing.

Drawn-temper copper tube, Type L with wrought-copper fittings and brazed joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, below building, piping shall be[ one of] the following:

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with wrought-steel fittings and welded joints.

Indicate extent of containment conduit on Drawings. Containment conduit is required for piping under buildings.

Retain both paragraphs below for piping below building.

* + - * 1. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
				2. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
			1. INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN5 PSIG

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, branch piping [**NPS 1] <Insert pipe size**> and smaller shall be[ one of] the following:

Verify acceptability of corrugated stainless-steel tubing with authorities having jurisdiction before retaining first subparagraph below.

Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.

Tin-lined tube in first subparagraph below is available in 1/4- to 5/8-inch OD and is equivalent to NPS 1/8 to NPS 1/2 (DN 6 to DN 15). Retain if branch piping is NPS 1/2 (DN 15) or smaller; delete if branch piping larger than NPS 1/2 (DN 15) is required.

Annealed-temper, tin-lined copper tube with flared joints and fittings.

Annealed-temper copper tube, Type L with wrought-copper fittings and [brazed] [flared] joints.

Aluminum tube with flared fittings and joints.

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, distribution piping shall be[ **one of**] the following:

Authorities having jurisdiction may require welded steel pipe at different sizes and pressures. Verify size break and insert sizes to suit Project.

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with steel welding fittings and welded joints.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing. Type G copper pipe and tube is permitted in CSA B149.1.

Drawn-temper copper tube, [**Type L] [Type G**] with wrought-copper fittings and brazed joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, below building, piping shall be[ **one of**] the following:

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with wrought-steel fittings and welded joints.

Indicate extent of containment conduit on Drawings. Containment conduit is required for piping under buildings.

Retain both paragraphs below for piping below building.

* + - * 1. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
				2. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
			1. INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

* + - * 1. Aboveground Piping: Maximum operating pressure more than [**5 psig] <Insert pressure**>.
				2. Aboveground, Branch Piping: Schedule 40, steel pipe with steel welding fittings and welded joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, distribution piping shall be [ **one of**] the following:

Schedule 40, steel pipe with steel welding fittings and welded joints.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing. Type G copper pipe and tube is permitted in CSA B149.1.

Drawn-temper copper tube, [**Type L] [Type G**] with wrought-copper fittings and brazed joints.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, below building, piping shall be [ **one of**] the following:

Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

Schedule 40, steel pipe with wrought-steel fittings and welded joints.

Indicate extent of containment conduit on Drawings. Containment conduit is required for piping under buildings.

Retain both paragraphs below for piping below building.

* + - * 1. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
				2. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
			1. UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

* + - * 1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
				2. Underground Vapor Piping:

Retain first subparagraph below for PE piping.

PE valves.

Retain both subparagraphs below for steel or PE piping.

NPS 2 and Smaller: Bronze, [**lubricated] [nonlubricated**] plug valves.

NPS 2-1/2 and Larger: Cast-iron, [**lubricated] [nonlubricated**] plug valves.

* + - 1. ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

* + - * 1. Aboveground Liquid Piping:

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Valves for pipe NPS 2 and smaller at service meter shall be[ **one of**] the following:

One-piece, bronze ball valve with bronze trim.

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze plug valve.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Valves for pipe NPS 2-1/2 and larger at service meter shall be[ one of] the following:

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze plug valve.

Cast-iron, nonlubricated plug valve.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Distribution piping valves for pipe NPS 2 and smaller shall be[ **one of**] the following:

One-piece, bronze ball valve with bronze trim.

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze plug valve.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Distribution piping valves for pipe NPS 2-1/2 and larger shall be[ one of] the following:

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze plug valve.

Cast-iron, [**nonlubricated] [lubricated**] plug valve.

Retain "one of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Valves in branch piping for single appliance shall be[ **one of**] the following:

One-piece, bronze ball valve with bronze trim.

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze plug valve.

END OF SECTION 231126