State of Nevada
Department of Administration

Purchasing Division

515 E. Musser Street, Suite 300
Carson City, NV 89701

Brian Sandoval
Governor

Jeff Mohlenkamp
Director

Greg Smith
Administrator

State of Nevada

Purchasing Division

Request for Qualifications: 3064

For

BULK FUEL PURCHASE AND DELIVERY SERVICE

Release Date: August 19, 2013

Deadline for Submission and Opening Date and Time: October 9, 2013 @ 2:00 PM

Refer to Section 11, RFQ Timeline for the complete RFQ schedule

For additional information, please contact:

Nancy Feser, Buyer

State of Nevada, Purchasing Division

515 E. Musser Street, Suite 300

Carson City, NV 89701

Phone: 775-684-0175

Email address: nfeser@admin.nv.gov

(TTY for Deaf and Hard of Hearing: 1-800-326-6868
Ask the relay agent to dial: 1-775-684-0175/V.)

Refer to Section 12 for instructions on submitting proposals

VENDOR INFORMATION SHEET FOR RFQ 3064

Vendor Must:

A) Provide all requested information in the space provided next to each numbered question. The information provided in Sections V1 through V6 will be used for development of the contract;

B) Type or print responses; and

C) Include this Vendor Information Sheet in Tab III of the Technical Proposal.

V1	Company Name	AmeriGas Propane, L.P.
V2	Street Address	460 N. Gulph Road
V3	City, State, ZIP	King of Prussia

	Telephone Number		
V4	Area Code: 610	Number: 768-3601	Extension:

	Facsimile Number		
V5	Area Code: 610	Number: 768-7694	Extension:

	Toll Free Number		
V6	Area Code: 888	Number: 528-9475	Extension: Opt 2

	Contact Person for Questions / Contract Negotiations, including address if different than above
V7	Name: Dawn Stevenson
	Title: Government Account Manager
	Address:
	Email Address:

	Telephone Number for Contact Person		
V8	Area Code: 610	Number: 768-3601	Extension:

	Facsimile Number for Contact Person		
V9	Area Code: 610	Number: 768-7694	Extension:

	Name of Individual Authorized to Bind the Organization	
V10	Name: Andrew Poyton	Title: V.P.

	Signature ***(Individual must be legally authorized to bind the vendor per NRS 333.337)***	
V11	Signature:	Date: 9/15/14

STATE OF NEVADA
VENDOR REGISTRATION

Mail or fax to:
STATE PURCHASING
515 E MUSSER ST STE 300
CARSON CITY NV 89701
PHONE: 775/684-0187
FAX: 775/684-0188

All sections are mandatory and require completion. IRS Form W-9 will not be accepted in lieu of this form.

1. NAME For proprietorship, provide proprietor's name in first box and DBA in second box.

Legal Business Name, Proprietor's Name or Individual's Name	Doing Business As (DBA)

2. ADDRESS/CONTACT INFORMATION

Address A – Physical address of ☑ Company Headquarters ☐ Individual's Residence. Is this a US Post Office deliverable address? ☑ Yes ☐ No			Address B ☐ Additional Remittance – PO Box, Lockbox or another physical location.		
Address: AmeriGas Propane, L.P.			Address		
Address: 460 N. Gulph Road			Address		
City: King of Prussia	State: PA	Zip Code: 19406	City	State	Zip Code
E-mail Address: Dawn.Stevenson@amerigas.com			E-mail Address		
Phone Number: 610-768-3601	Fax Number: 610-768-7694		Phone Number	Fax Number	
Primary Contact: Dawn Stevenson			Primary Contact		

3. ORGANIZATION TYPE AND TAX IDENTIFICATION NUMBER (TIN) Check only **one** organization type and supply the applicable Social Security Number (SSN) or Employee Identification Number (EIN). **For proprietorship, provide SSN or EIN, not both.**

☐ Individual (SSN) ☐ Sole Proprietorship (SSN or EIN) ☒ Partnership (EIN) ☐ Corporation (EIN) ☐ Government (EIN) ☐ Tax Exempt/Nonprofit (EIN) ☐ Trust/estate (SSN or EIN)	☐ LLC tax classification: ☐ Disregarded Entity ☐ Partnership ☐ Corporation	**SSN** Name associated with SSN: **EIN** 232787917 New TIN? ☐ No ☐ Yes – Provide previous TIN & effective date. Previous TIN: Date:

OTHER INFORMATION Check all that apply.

☐ Doctor or Medical Facility ☐ Attorney or Legal Facility	☐ In-State (Nevada) ☐ DBE Certificate #:	☐ Nevada Business License Number: NV19951024549

4. ELECTRONIC FUNDS TRANSFER *Per NRS 227, payment to all payees of the State of Nevada will be electronic.*
Complete the following information AND provide a copy of a voided imprinted check for the account. If there are no checks for the account, restate the bank information on company letterhead. Individuals may provide a signed letter. **A deposit slip will not be accepted.** For a savings account, provide a signed letter with the bank information. Information on this form and the support documentation **must match**. Allow 10 working days for activation.

The information is for address ☐ A ☐ B ☐ Both			
Bank Name: BNY Mellon	Bank Account Type: ☑ Checking ☐ Savings		Provide an e-mail address for receiving Direct Deposit Remittance Advices. LockBoxREmit@Amerigas.com
Transit Routing Number: 043000261	Bank Account Number: 0027481		

☐ Do not have a bank account.

5. IRS FORM W-9 CERTIFICATION AND SIGNATURE

Under penalties of perjury, I certify that:
1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (as defined by IRS Form W-9 rev January 2011).

Cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return.

The Internal Revenue Service does not require your consent to any provision of this document other than the certifications required to avoid backup withholding.

Signature	Print Name & Title of Person Signing Form	Date
Irene Corner	Irene CORNER	9/9/14

FOR STATE CONTROLLER'S OFFICE USE ONLY		Name of State agency contact & phone number:
Primary 1099 Vendor ☐	1099 Indicator ☐ Yes ☐ No	
Entered By	Date	Comments

THE BANK OF NEW YORK MELLON

BNY Mellon Treasury Services
ACH/Wire Transfer Specifications

For technical information, contact BNY Mellon ACH customer service at 412-236-3338

Transit Routing Number	**043000261**
Account Number	**0027481**
Account Title	**Amerigas Propane LP**

Prepared by:	**Deborah L. Mezyk**
Title:	**Client Support Officer**
Phone:	**412-234-2559**
Date:	**June 17, 2013**

Deborah Mezyk

Signature

AmeriGas®
America's Propane Company

Dear AmeriGas Customer,

AmeriGas Propane L.P. now is available to receive payment through Electronic Funds Transfer (EFT). With the information provided in this letter, making payment to our company should prove to be quick and easy. All AmeriGas accounts should be set up accordingly in your system. If you are an existing EFT Customer, please review the information below and update us in your system. If you have any questions, you may reach Irene Corner, Lead Accounting Assistant, at 610-337-7000 extension 28144 or by email at Irene.Corner@AmeriGas.com.
We thank you for your time and for choosing AmeriGas.

Sincerely,

Denise MacDonald, Supervisor

Name on Account:	AmeriGas Propane L.P.
Address:	P.O. BOX 965 Valley Forge, Pa 19482
Main Contact:	Irene Corner
Phone:	610-337-7000 ext 28144
Fax:	610-768-3834
Bank Name:	BNY Mellon
Address:	One Mellon Bank Center, Pittsburgh, Pa 15239
Contact:	Debbie Mezyk- Client Services
Phone:	412-234-2559
Fax:	724-540-6826
ABA Transit Routing:	043000261
Account Number:	0027481
Type:	Checking
Federal TAX ID	23-2787917

Our method of remittance in order of preference (please note, we do not receive remittance via U.S.Postal Service):

1) CTX
2) 2)Email: LOCKBOXREMIT@AMERIGAS.COM
3) Fax: 610-768-3834 Attention: Irene Corner

AmeriGas®
America's Propane Company

In an effort to process all EFT payments as quickly as possible, please provide us with the following information:

Your Company Name _____

Name of Company Making Payments:_____
(if different from yours)

Remittance Advice: Please circle one: CTX EMAIL FAX

Contact Name:_____

Phone Number:_____

Email address:_____

Fax Number:_____

Accounts payable phone:_____

Accounts payable fax:_____

Your account numbers with us:_____

List any subsidiaries, holdings, divisions of
DBA'S_____

In the event we need to contact you concerning a payment made to us, please list any information we will need to provide (I.E Vendor
number)_____

Please return by fax to 610-768-3834 Attention Irene Corner, Lockbox Dept.
Send remit to lockboxremit@amerigas.com.

Questions? Please contact Irene at 610-337-7000 ext 28144

Form **W-9**
(Rev. August 2013)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

Name (as shown on your income tax return)
Amerigas Propane, LP

Business name/disregarded entity name, if different from above

Check appropriate box for federal tax classification:
☐ Individual/sole proprietor ☐ C Corporation ☐ S Corporation ☑ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶

☐ Other (see instructions) ▶

Exemptions (see instructions):
Exempt payee code (if any)
Exemption from FATCA reporting code (if any)

Address (number, street, and apt. or suite no.)
PO Box 965

Requester's name and address (optional)

City, state, and ZIP code
Valley Forge, PA 19482-0965

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number
			–			–				

Employer identification number
2	3	–	2	7	8	7	9	1	7

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below), and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3.

Sign Here Signature of U.S. person ▶ [signature] Date ▶ 01/09/2014

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. The IRS has created a page on IRS.gov for information about Form W-9, at *www.irs.gov/w9*. Information about any future developments affecting Form W-9 (such as legislation enacted after we release it) will be posted on that page.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, payments made to you in settlement of payment card and third party network transactions, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct.

Note. If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

ATTACHMENT C – VENDOR CERTIFICATIONS

Vendor agrees and will comply with the following:

(1) Any and all prices that may be charged under the terms of the contract do not and will not violate any existing federal, State or municipal laws or regulations concerning discrimination and/or price fixing. The vendor agrees to indemnify, exonerate and hold the State harmless from liability for any such violation now and throughout the term of the contract.

(2) All proposed capabilities can be demonstrated by the vendor.

(3) The price(s) and amount of proposal will be arrived independently and without consultation, communication, agreement or disclosure with or to any other contractor, vendor or potential vendor.

(4) All proposal terms, will remain in effect for a minimum of 180 days after the proposal due date. In the case of the awarded vendor, all proposal terms, will remain in effect throughout the contract negotiation process.

(5) No attempt has been made at any time to induce any firm or person to refrain from proposing or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal. All proposals must be made in good faith and without collusion.

(6) All conditions and provisions of this RFQ are deemed to be accepted by the vendor and incorporated by reference in the proposal, except such conditions and provisions that the vendor expressly excludes in the proposal. Any exclusion must be in writing and included in the proposal at the time of submission.

(7) Each vendor must disclose any existing or potential conflict of interest relative to the performance of the contractual services resulting from this RFQ. Any such relationship that might be perceived or represented as a conflict should be disclosed. By submitting a proposal in response to this RFQ, vendors affirm that they have not given, nor intend to give at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to a public servant or any employee or representative of same, in connection with this procurement. Any attempt to intentionally or unintentionally conceal or obfuscate a conflict of interest will automatically result in the disqualification of a vendor's proposal. An award will not be made where a conflict of interest exists. The State will determine whether a conflict of interest exists and whether it may reflect negatively on the State's selection of a vendor. The State reserves the right to disqualify any vendor on the grounds of actual or apparent conflict of interest.

(8) All employees assigned to the project are authorized to work in this country.

(9) The company has a written equal opportunity policy that does not discriminate in employment practices with regard to race, color, national origin, physical condition, creed, religion, age, sex, marital status, sexual orientation, developmental disability or handicap.

(10) The company has a written policy regarding compliance for maintaining a drug-free workplace.

(11) Vendor understands and acknowledges that the representations within their proposal are material and important, and will be relied on by the State in evaluation of the proposal. Any vendor misrepresentations shall be treated as fraudulent concealment from the State of the true facts relating to the proposal.

(12) Vendor must certify that any and all subcontractors comply with Sections 7, 8, 9, and 10, above.

(13) The proposal must be signed by the individual(s) legally authorized to bind the vendor per NRS 333.337.

AmeriGas Propane, L.P.
Vendor Company Name

Vendor Signature

ANDREW PEYTON
Print Name

9/15/14
Date

This document must be submitted in Tab IV of vendor's technical proposal

ATTACHMENT B – TECHNICAL PROPOSAL CERTIFICATION OF COMPLIANCE WITH TERMS AND CONDITIONS OF RFQ

I have read, understand and agree to comply with the terms and conditions specified in this Request for Qualifications.

YES _____ I agree to comply with the terms and conditions specified in this RFQ.

NO ✓ I do not agree to comply with the terms and conditions specified in this RFQ.

In order for any exceptions and/or assumptions to be considered they **MUST** be documented in detail in the tables below. The State will not accept additional exceptions and/or assumptions if submitted after the proposal submission deadline. Vendors must be specific. Nonspecific exceptions or assumptions may not be considered. If the exception or assumption requires a change in the terms or wording of the contract, the scope of work, or any incorporated documents, vendors must provide the specific language that is being proposed in the tables below.

AmeriGas Propane, L.P.
Company Name

Signature

Andrew Peyton
Print Name

9/15/14
Date

Vendors MUST use the following format. Attach additional sheets if necessary.

EXCEPTION SUMMARY FORM

RFQ SECTION NUMBER	RFQ PAGE NUMBER	EXCEPTION (Complete detail regarding exceptions must be identified)
4	13	Our billing system is unable to include copies of delivery tickets / bill of lading with invoices. We will leave copies at the delivery location with the person signing for the delivery.

ASSUMPTION SUMMARY FORM

RFQ SECTION NUMBER	RFQ PAGE NUMBER	ASSUMPTION (Complete detail regarding assumptions must be identified)

This document must be submitted in Tab V of vendor's technical proposal

NFPA® 58

Liquefied Petroleum Gas Code

2014 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

ANSI/CGA C-7, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers*, 2011.

CGA S-1.1, *Pressure Relief Device Standards, Part 1— Cylinders for Compressed Gases*, 2011.

CGA S-1.3, *Pressure Relief Device Standards, Part 3 — Stationary Storage Containers for Compressed Gases*, 2008.

CGA V-1, *Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections*, 2008.

2.3.6 CSA America Publications. CSA America, Inc., 8501 East Pleasant Valley Road, Cleveland, OH 44131-5575.

ANSI/CSA 6.26 (LC1), *Interior Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing*, 2005.

ANSI Z21.18/CSA 6.3, *Gas Appliance Regulators*, 2007.

ANSI Z21.80/CSA 6.22, *Standard for Line Pressure Regulators*, 2003 (Reaffirmed 2008).

2.3.7 NBBPVI Publications. National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, OH 43229.

ANSI/NB23, *National Board Inspection Code*, 2011.

2.3.8 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 21, *Standard for LP-Gas Hose*, 2007, Revised 2010.

ANSI/UL 125, *Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas (Other than Safety Relief)*, 2009, Revised 2011.

ANSI/UL 132, *Standard for Safety Relief Valves for Anhydrous Ammonia and LP-Gas*, 2007, Revised 2010.

ANSI/UL 144, *Standard for LP-Gas Regulators*, 2012.

ANSI/UL 147A, *Standard for Nonrefillable (Disposable) Type Fuel Gas Cylinder Assemblies*, 2005, Revised 2009.

ANSI/UL 147B, *Standard for Nonrefillable (Disposable) Type Metal Container Assemblies for Butane*, 2005, Revised 2008.

ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, 2011.

ANSI/UL 514B, *Standard for Conduit, Tubing, and Cable Fittings*, 2004, Revised 2009.

ANSI/UL 567, *Standard for Emergency Breakaway Fittings, Swivel Connectors, and Pipe-Connection Fittings for Petroleum Products and LP-Gas*, 2003, Revised 2011.

ANSI/UL 569, *Standard for Pigtails and Flexible Hose Connectors for LP-Gas*, 1995, Revised 2009.

ANSI/UL 651, *Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings*, 2011, Revised 2012.

ANSI/UL 1660, *Standard for Liquid-Tight Flexible Nonmetallic Conduit*, 2004, Revised 2008.

ANSI/UL 1769, *Standard for Cylinder Valves*, 2006, Revised 2011.

ANSI/UL 2227, *Standard for Overfilling Prevention Devices*, 2007, Revised 2009.

2.3.9 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 49, Code of Federal Regulations, Parts 173.301(h)(3), 173.315(n), and 192.283(b).

Title 49, Code of Federal Regulations, Part 192.281(e), "Transportation." (Also available from the Association of American Railroads, American Railroads Bldg., 1920 L Street, N.W., Washington, DC 20036 and American Trucking Assns., Inc., 2201 Mill Road, Alexandria, VA 22314.)

Federal Motor Carrier Safety Regulations.

Interstate Commerce Commission (ICC) *Rules for Construction of Unfired Pressure Vessels*, U.S. Department of Transportation, Washington, DC.

2.3.10 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 54, *National Fuel Gas Code*, 2012 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.5* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.6 Shall. Indicates a mandatory requirement.

3.2.7 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Actuated Liquid Withdrawal Excess-Flow Valve. See 3.3.75.1.

3.3.2 Anodeless Riser. A transition assembly used between underground polyethylene or polyamide pipe and aboveground metal piping or equipment, and terminating aboveground outside of a building.

3.3.3 ANSI. American National Standards Institute.

3.3.4 API. American Petroleum Institute.

3.3.5 API-ASME Container (or Tank). A container constructed in accordance with the pressure vessel code jointly developed by the American Petroleum Institute and the American Society of Mechanical Engineers.

3.3.6 ASME. American Society of Mechanical Engineers.

3.3.7 ASME Code. The American Society of Mechanical Engineers *Boiler and Pressure Vessel Code.*

3.3.8 ASME Container. A container constructed in accordance with the ASME Code.

3.3.9 ASTM. American Society for Testing and Materials.

3.3.10* Bulk Plant. A facility that stores LP-Gas in containers of more than 4000 gal (15.2 m^3) water capacity prior to further distribution as a liquid for use at other facilities.

3.3.11 Cargo Tank. A container that is used to transport LP-Gas as liquid cargo that either is mounted on a conventional truck chassis or is an integral part of a cargo transporting vehicle.

3.3.12 CGA. The Compressed Gas Association.

3.3.13 Concrete Pad. A foundation consisting of solid concrete or masonry blocks, a placed concrete slab, or a poured concrete foundation.

3.3.14 Container. Any vessel, including cylinders, tanks, portable tanks, and cargo tanks, used for the transporting or storing of LP-Gases.

3.3.15 Container Appurtenances. Devices installed in container openings for safety, control, or operating purposes.

3.3.16 Container Assembly. An assembly consisting of the container and fittings for all container openings such as shutoff valves, excess-flow valves, liquid level gauging devices, pressure relief devices, and protective housings.

3.3.17 Cylinder. A container designed, constructed, tested, and marked in accordance with U.S. Department of Transportation specifications, Title 49, Code of Federal Regulations, or in accordance with a valid DOT special permit.

3.3.17.1 *Universal Cylinder.* A cylinder that can be connected for service in either the vertical or the horizontal position, so that the fixed maximum liquid level gauge, pressure relief device, and withdrawal appurtenances function properly in either position.

3.3.18 Design Certification. The process by which a product is evaluated and tested by an independent laboratory to affirm that the product design complies with specific requirements.

3.3.19 Design Pressure. The maximum pressure at which the equipment or system is designed to operate.

3.3.20 Dispensing Station. Fixed equipment in which LP-Gas is stored and dispensed into portable containers.

3.3.21 DOT. U.S. Department of Transportation.

3.3.22 Facility Hose. A hose and its couplings permanently installed for the purpose of unloading product from cargo tank motor vehicles in nonmetered service into a bulk plant or industrial plant.

3.3.23 Filling.

3.3.23.1 *Volumetric Method Filling.* Filling a container to not more than the maximum permitted liquid volume.

3.3.23.2 *Weight Method Filling.* Filling containers to not more than the maximum permitted filling limit by weighing the LP-Gas in the container.

3.3.24* Fire Protection. Includes fire prevention, fire detection, and fire suppression.

3.3.25 Flexible Connector. A short [not exceeding 60 in. (1.52 m) overall length] fixed piping system component that is fabricated from a flexible material and equipped with connections at both ends.

3.3.25.1 *Flexible Hose Connector.* A component fabricated from LP-Gas hose that is made from a material that is compatible with LP-Gas.

3.3.25.2 *Flexible Metallic Connector.* A component fabricated from metallic material that provides liquid and vapor LP-Gas confinement and is provided with connections on both ends.

3.3.25.3 *Metallic-Protected Flexible Hose Connector.* A flexible hose connector that is provided with a metallic material over wrap that provides mechanical protection of the inner hose but does not provide fluid confinement.

3.3.26 Gallon, U.S. Standard. 1 U.S. gal = 0.833 Imperial gal = 231 $in.^3$ = 3.785 L.

3.3.27* Gas. For the purposes of this code, liquefied petroleum gas (LP-Gas) in either the liquid or vapor state.

3.3.28* Gas–Air Mixer. A device or a system of piping and controls that mixes LP-Gas vapor with air to produce a mixed gas of a lower heating value than the LP-Gas.

3.3.29 Gauge.

3.3.29.1 *Fixed Liquid Level Gauge.* A liquid level indicator that uses a positive shutoff vent valve to indicate that the liquid level in a container being filled has reached the point at which the indicator communicates with the liquid level in the container.

3.3.29.2 *Fixed Maximum Liquid Level Gauge.* A fixed liquid level gauge that indicates the liquid level at which the container is filled to its maximum permitted filling limit.

3.3.29.3 *Float Gauge.* A gauge constructed with an element installed inside the container that floats on the liquid surface and transmits its position to a device outside the container to indicate the liquid level.

3.3.29.4 *Magnetic Gauge.* See 3.3.29.3, Float Gauge.

3.3.29.5 *Rotary Gauge.* A type of variable liquid level gauge that indicates the liquid level on a dial gauge installed on an ASME container by manually rotating an open ended tube inside the container, which is connected to a positive shutoff vent valve.

3.3.29.6* *Slip Tube Gauge.* A variable liquid level gauge in which a small positive shutoff valve is located at the outside end of a straight tube that is installed vertically within a container.

3.3.29.7 *Variable Liquid Level Gauge.* A device that indicates the liquid level in a container throughout a range of levels.

3.3.30 GPA. Gas Processors Association.

3.3.31 ICC. U.S. Interstate Commerce Commission.

3.3.32 Ignition Source. See 3.3.69, Sources of Ignition.

3.3.33 Industrial Occupancy. Includes factories that manufacture products of all kinds and properties devoted to operations such as processing, assembling, mixing, packaging, finishing or decorating, and repairing.

3.3.34* Industrial Plant. A facility that stores LP-Gas in containers of water capacity more than 4000 gal (15.2 m^3) for use at the facility or to distribute vapor to other facilities.

3.3.35 kPa. Absolute pressure in kilo-Pascals.

3.3.36 kPag. Gauge pressure in kilo-Pascals.

3.3.37 Leak Check. An operation performed on a gas piping system to verify that the system does not leak. [54, 2012]

3.3.38* Liquefied Petroleum Gas (LP-Gas). Any material having a vapor pressure not exceeding that allowed for commercial propane that is composed predominantly of the following hydrocarbons, either by themselves (except propylene) or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes.

3.3.39* Low Emission Transfer. Establishes a maximum fugitive emissions standard for certain product transfer operations.

3.3.40 LP-Gas System. An assembly consisting of one or more containers with a means for conveying LP-Gas from a container to dispensing or consuming devices that incorporates components that control the quantity, flow, pressure, and physical state (liquid or vapor) of the LP-Gas.

3.3.41 Maximum Allowable Working Pressure (MAWP). The maximum pressure at which a pressure vessel is to operate as described by the ASME *Code*.

3.3.42 Mobile Container. A container that is permanently mounted on a vehicle and connected for uses other than supplying engine fuel.

3.3.43 Mounded Container. An ASME container designed for underground service installed above the minimum depth required for underground service and covered with earth, sand, or other material, or an ASME container designed for aboveground service installed above grade and covered with earth, sand, or other material.

3.3.44* Movable Fuel Storage Tender. A container equipped with wheels (including a farm cart) not in excess of 1200 gal (4.5 m^3) water capacity that is moved from one location to another.

3.3.45 MPa. Absolute pressure in mega-Pascals.

3.3.46 MPag. Gauge pressure in mega-Pascals.

3.3.47 NFPA. National Fire Protection Association.

3.3.48 NPGA. National Propane Gas Association.

3.3.49 Overfilling Prevention Device (OPD). A safety device that is designed to provide an automatic means to prevent the filling of a container in excess of the maximum permitted filling limit.

3.3.50 Overpressure Shutoff Device. A device that shuts off the flow of LP-Gas vapor when the outlet pressure of the regulator reaches a predetermined maximum allowable pressure.

3.3.51 Permanent Installation. See 3.3.72, Stationary Installation.

3.3.52 Permitted. Allowed or acceptable, and not requiring a permit (a document granting permission) to be secured.

3.3.53 Piping Systems. Pipe, tubing, hose, and flexible rubber or metallic hose connectors with valves and fittings made into complete systems for conveying LP-Gas from one point to another in either the liquid or the vapor state at various pressures.

3.3.54 Point of Transfer. The location where connections and disconnections are made or where LP-Gas is vented to the atmosphere in the course of transfer operations.

3.3.55* Portable Container. A container designed to be moved readily, as opposed to a container designed for stationary installations.

3.3.56* Portable Storage Container. A container that is designed and constructed to be moved over a highway from one usage location to another.

3.3.57 Portable Tank (or Skid Tank). A container of more than 1000 lb (454 kg) water capacity that is equipped with protected container appurtenances, is used to transport LP-Gas, and is designed and fabricated with permanently mounted skids or runners or is fabricated and installed within a full framework.

3.3.58 Pressure Relief Device. A device designed to open to prevent a rise of internal pressure in excess of a specified value.

3.3.59 Pressure Test. An operation performed to verify the gastight integrity of gas piping following its installation or modification. [54, 2012]

3.3.60 psi. Pounds per square inch.

3.3.61 psia. Pounds per square inch absolute.

3.3.62 psig. Pounds per square inch gauge.

3.3.63 Quick Connectors. Fittings used to connect hose assemblies to piping and valves without the use of tools.

3.3.64* Refrigerated LP-Gas. LP-Gas that is cooled to temperatures below ambient to maintain the product as a liquid with a vapor pressure of 15 psig (103 kPag) or less.

3.3.65 Regulator.

3.3.65.1* *Automatic Changeover Regulator.* An integral two-stage regulator that combines two high-pressure regulators and a second-stage regulator into a single unit designed for use with multiple cylinder installations.

3.3.65.2 *First-Stage Regulator.* A pressure regulator for LP-Gas vapor service designed to reduce pressure from a container to 10 psig (69 kPag) or less.

3.3.65.3 *High-Pressure Regulator.* A pressure regulator for LP-Gas liquid or vapor service designed to reduce pressure from the container to a lower pressure in excess of 1.0 psig (6.9 kPag).

3.3.65.4 *Integral 2 psi Service Regulator.* A pressure regulator for LP-Gas vapor service that combines a high-pressure regulator and a 2 psi (14 kPag) service regulator into a single unit.

3.3.65.5 *Integral Two-Stage Regulator.* A pressure regulator for LP-Gas vapor service that combines a high-pressure regulator and a second-stage regulator into a single unit.

3.3.65.6 *Line Pressure Regulator.* A pressure regulator in accordance with ANSI Z21.80/CSA 6.22, *Standard for Line Pressure Regulators,* with no integral overpressure protection device for LP-Gas vapor service designed for installation inside a building to reduce a nominal 2 psig (14 kPag) inlet pressure to 14 in. w.c. (4.0 kPa) or less.

3.3.65.7 *Second-Stage Regulator.* A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to the pressure required at the point of delivery.

3.3.65.8 *Single-Stage Regulator.* A pressure regulator for LP-Gas vapor service designed to reduce pressure from the container to 1.0 psig (6.9 kPag) or less.

3.3.65.9 *2 psi Regulator System.* An LP-Gas vapor delivery system that combines a first-stage regulator, a 2 psi (14 kPag) service regulator, and a line pressure regulator(s).

3.3.65.10 *2 psi Service Regulator.* A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to a nominal 2 psig (14 kPag).

3.3.65.11 *Two-Stage Regulator System.* An LP-Gas vapor delivery system that combines a first-stage regulator and a second-stage regulator(s), or utilizes a separate integral two-stage regulator.

3.3.66 SCFM. Standard cubic feet per minute.

3.3.67 Service Head Adapter. A transition fitting for use with polyethylene or polyamide pipe or tubing that is recommended by the manufacturer for field assembly and installation at the aboveground termination end of an anodeless riser.

3.3.68 Skid Tank. See 3.3.57, Portable Tank.

3.3.69 Sources of Ignition. Devices or equipment that, because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable LP-Gas vapor–air mixtures when introduced into such a mixture or when such a mixture comes into contact with them, and that will permit propagation of flame away from them.

3.3.70* Special Protection. A means of limiting the temperature of an LP-Gas container for purposes of minimizing the possibility of failure of the container as the result of fire exposure.

3.3.71 Standard Cubic Foot (SCF). The volume of gas in cubic feet at the standard atmospheric conditions at 60°F (15.6°C) and 14.7 psia (101 kPa).

3.3.72 Stationary Installation (Permanent Installation). An installation of LP-Gas containers, piping, and equipment for indefinite use at a particular location; an installation not normally expected to change in status, condition, or location.

3.3.73 Tank Heater (Indirect and Direct Types). A device used to apply heat either directly to a portion of the container surface in contact with LP-Gas liquid or indirectly by circulating LP-Gas liquid from the container to the device and then back to the container.

3.3.73.1 *Direct Gas-Fired Tank Heater.* A gas-fired device that applies heat directly to the container surface in contact with LP-Gas liquid.

3.3.74 UL. Underwriters Laboratories Inc.

3.3.75 Valve.

3.3.75.1 *Actuated Liquid Withdrawal Excess-Flow Valve.* A container valve that is opened and closed by an adapter, incorporates an internal excess flow valve, and is used to withdraw liquid from the container.

3.3.75.2 *Emergency Shutoff Valve.* A shutoff valve incorporating thermal and manual means of closing that also provides for remote means of closing.

3.3.75.3 *Excess-Flow Valve (or Excess-Flow Check Valve).* A valve designed to close when the liquid or vapor passing through it exceeds a prescribed flow rate.

3.3.75.4 *Filler Valve.* A valve that is designed to allow liquid flow into a container.

3.3.75.5 *Internal Excess-Flow Valve.* An excess-flow valve constructed and installed so that damage to valve parts exterior to the container does not prevent closing of the valve.

3.3.75.6* *Internal Valve.* A container primary shutoff valve that can be closed remotely, which incorporates an internal excess flow valve with the seat and seat disc located within the container so that they remain in place should external damage occur to the valve.

3.3.75.7 *Positive Shutoff Valve.* A shutoff valve that, in the closed position, does not allow the flow of product in either direction.

3.3.75.8 *Pressure Relief Valve.* A type of pressure relief device designed to both open and close to maintain internal fluid pressure.

3.3.75.8.1* *External Pressure Relief Valve.* A pressure relief valve where all the working parts are located entirely outside the container or piping.

3.3.75.8.2* *Flush-Type Full Internal Pressure Relief Valve.* An internal pressure relief valve in which the wrenching section is also within the container connection, not including a small portion due to pipe thread tolerances on makeup.

3.3.75.8.3* *Full Internal Pressure Relief Valve.* A pressure relief valve in which all working parts are recessed within a threaded connection of the valve, and the spring and guiding mechanism are not exposed to the atmosphere.

3.3.75.8.4* *Internal Spring-Type Pressure Relief Valve.* A pressure relief valve that is similar to a full internal relief valve except the wrenching pads and seating section are above the container connection in which the adjusting spring and the stem are below the seat and are not exposed to the atmosphere.

3.3.76 Vaporizer. A device, other than a container, that receives LP-Gas in liquid form and adds sufficient heat to convert the liquid to a gaseous state.

3.3.76.1 *Direct-Fired Vaporizer.* A vaporizer in which heat furnished by a flame is directly applied to a heat exchange surface in contact with the liquid LP-Gas to be vaporized.

3.3.76.2 *Electric Vaporizer.* A vaporizer that uses electricity as a source of heat.

3.3.76.2.1 *Direct Immersion Electric Vaporizer.* A vaporizer wherein an electric element is immersed directly in the LP-Gas liquid and vapor.

3.3.76.2.2 *Indirect Electric Vaporizer.* An immersion-type vaporizer wherein the electric element heats an interface solution in which the LP-Gas heat exchanger is immersed or heats an intermediate heat sink.

3.3.76.3 *Indirect (or Indirect-Fired) Vaporizer.* A vaporizer in which heat furnished by steam, hot water, the ground, surrounding air, or other heating medium is applied to a vaporizing chamber or to tubing, pipe coils, or other heat exchange surface containing the liquid LP-Gas to be vaporized; the heating of the medium used is at a point remote from the vaporizer.

3.3.76.4 *Waterbath (or Immersion-Type) Vaporizer.* A vaporizer in which a vaporizing chamber, tubing, pipe coils, or other heat exchange surface containing liquid LP-Gas to be vaporized is immersed in a temperature-controlled bath of water, water-glycol combination, or other noncombustible heat transfer medium that is heated by an immersion heater not in contact with the LP-Gas heat exchange surface.

3.3.77 Vaporizing Burner (Self-Vaporizing Liquid Burner). A burner that also vaporizes liquid LP-Gas prior to burning it.

3.3.78 Vehicle Fuel Dispenser. A device or system designed to transfer and measure LP-Gas into engine fuel and mobile containers on vehicles.

3.3.79* Vehicular Barrier Protection (VBP). A system or method to provide physical protection for LP-Gas storage areas or installations from vehicular incursion.

3.3.80 Volumetric Loading. See 3.3.23.1, Volumetric Method Filling.

3.3.81 Water Capacity. The amount of water at 60°F (16°C) required to fill a container.

Chapter 4 General Requirements

4.1 Acceptance of Equipment and Systems.

4.1.1 Systems or components assembled to make up systems shall be approved as specified in Table 4.1.1.

4.1.2 Where it is necessary to alter or repair such systems or assemblies, approved components shall be used.

4.1.3 Acceptance applies to the complete system or to the individual components of which it is comprised as specified in Table 4.1.1.

4.2 LP-Gas Odorization.

4.2.1* All LP-Gases shall be odorized prior to delivery to a bulk plant by the addition of a warning agent of such character that the gases are detectable, by a distinct odor, to a concentration in air of not over one-fifth the lower limit of flammability.

4.2.2 Odorization shall not be required if it is harmful in the use or further processing of the LP-Gas or if such odorization will serve no useful purpose as a warning agent in such further use or processing.

4.2.3* If odorization is required, the presence of the odorant shall be determined by sniff-testing or other means, and the results shall be documented as follows:

(1) When LP-Gas is delivered to a bulk plant
(2) When shipments of LP-Gas bypass the bulk plant

4.3 Notification of Installations.

4.3.1 Stationary Installations. Plans for stationary installations utilizing storage containers with aggregate water capacity exceeding 4000 gal (15.2 m^3) and all rooftop installations of ASME containers shall be submitted to the authority having jurisdiction before the installation is started by the person or company that either installs or contracts to have the containers installed. *[See also 6.20.11.1(F).]*

4.3.2 Temporary Installations.

4.3.2.1 The authority having jurisdiction shall be notified of temporary installations of the container sizes covered in 4.3.1 before the installation is started.

4.3.2.2 Where temporary installations exceed 12 months, approval shall be obtained.

Table 4.1.1 Containers

Containers Used	Water Capacity gal	Water Capacity m^3	Approval Applies to ...
Cylinders	<120	<0.445	Container valves and connectors Manifold valve assemblies Regulators and pressure relief devices
ASME containers	≤2000	≤7.6	Container system,* including regulator, or container assembly* and regulator separately
ASME containers	>2000	>7.6	Container valves Container excess-flow valves, backflow check valves, or alternate means of providing this protection, such as remotely controlled internal valves Container gauging devices Regulators and container pressure relief devices

*Where necessary to alter or repair such systems or assemblies in the field in order to provide for different operating pressures, change from vapor to liquid withdrawal, or the like. Such changes are permitted to be made by the use of approved components.

4.3.3 Railcar to Cargo Tank Transfer.

4.3.3.1 Notification of intent for transfer of LP-Gas directly from railcar to cargo tank shall be submitted to the authority having jurisdiction before the first transfer.

4.3.3.2 The authority having jurisdiction shall have the authority to require inspection of the site or equipment for such transfer prior to the initial transfer.

4.4* Qualification of Personnel.

4.4.1 Persons whose duties fall within the scope of this code shall be provided with training that is consistent with the scope of their job activities and that includes proper handling and emergency response procedures.

4.4.2 Persons whose primary duties include transporting LP-Gas, transferring liquid LP-Gas into or out of stationary containers, or making stationary installations shall complete training that includes the following components:

(1) Safe work practices
(2) The health and safety hazards of LP-Gas
(3) Emergency response procedures
(4) Supervised, on-the-job training
(5) An assessment of the person's ability to perform the job duties assigned

4.4.3* Refresher training shall be provided at least every 3 years.

4.4.4 Initial and subsequent refresher training shall be documented.

4.5* Ammonia Contamination.

4.5.1 LP-Gas stored or used in systems within the scope of this code shall contain less ammonia than is required to turn the color of red litmus paper to blue.

4.5.2 A test for ammonia shall be performed on the LP-Gas prior to the initial use or transfer of LP-Gas from a transportation or storage system that has been converted from ammonia service.

4.6* Minimum Requirements. For any purpose or application addressed within the scope of this code, where the minimum requirements of the code are met, additional features or components of equipment not prohibited by the code shall be permitted to be used.

Chapter 5 LP-Gas Equipment and Appliances

5.1* Scope. This chapter applies to individual components and components shop-fabricated into subassemblies, container assemblies, and complete container systems.

5.2 Containers.

5.2.1 General.

5.2.1.1* Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with the regulations of the U.S. Department of Transportation (DOT); the ASME *Code*, Section VIII, "Rules for the Construction of Unfired Pressure Vessels"; or the API-ASME *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, except for UG-125 through UG-136.

(A) Used containers constructed to specifications of the Association of American Railroads shall not be installed.

(B) Adherence to applicable ASME Code case interpretations and addenda that have been adopted and published by ASME 180 calendar days prior to the effective date of this code shall be considered as compliant with the ASME Code.

(C) Where containers fabricated to earlier editions of regulations, rules, or codes listed in 5.2.1.1, and of the Interstate Commerce Commission (ICC) *Rules for Construction of Unfired Pressure Vessels*, prior to April 1, 1967, are used, the requirements of Section 1.4 shall apply.

5.2.1.2 Containers that have been involved in a fire and show no distortion shall be requalified for continued service before being used or reinstalled.

(A) Cylinders shall be requalified by a manufacturer of that type of cylinder or by a repair facility approved by DOT.

(B) ASME or API-ASME containers shall be retested using the hydrostatic test procedure applicable at the time of the original fabrication.

(C) All container appurtenances shall be replaced.

(D) DOT 4E specification (aluminum) cylinders and composite cylinders involved in a fire shall be permanently removed from service.

5.2.1.3 ASME paragraph U-68 or U-69 containers shall be permitted to be continued in use, installed, reinstalled, or placed back into service. Installation of containers shall be in accordance with all provisions listed in this code. *[See Section 5.2, Table 5.2.4.2 and Table 5.7.2.5(A), and Annex D.]*

5.2.1.4 Containers that show excessive denting, bulging, gouging, or corrosion shall be removed from service.

5.2.1.5 Except for containers used in cargo tank vehicle service, ASME containers of 3000 gal (11.4 m^3) water capacity or less used to store anhydrous ammonia shall not be converted to LP-Gas fuel service.

5.2.1.6 Repairs or alteration of a container shall comply with the regulations, rules, or code under which the container was fabricated. Repairs or alteration to ASME containers shall be in accordance with the ANSI/NB23 *National Board Inspection Code.*

5.2.1.7 Field welding shall be permitted only on saddle plates, lugs, pads, or brackets that are attached to the container by the container manufacturer.

5.2.1.8 Containers for general use shall not have individual water capacities greater than 120,000 gal (454 m^3).

5.2.1.9 Containers in dispensing stations not located in LP-Gas bulk plants or industrial plants shall have an aggregate water capacity not greater than 30,000 gal (114 m^3).

5.2.1.10 Heating or cooling coils shall not be installed inside storage containers.

5.2.1.11 ASME containers installed underground, partially underground, or as mounded installations shall incorporate provisions for cathodic protection and shall be coated with a material recommended for the service that is applied in accordance with the coating manufacturer's instructions.

5.2.2 Cylinders.

5.2.2.1* Cylinders shall be continued in service and transported in accordance with DOT regulations.

5.2.2.2 A cylinder with an expired requalification date shall not be refilled until it is requalified by the methods prescribed in DOT regulations.

5.2.3 Cylinders Filled on Site at the Point of Use.

5.2.3.1 DOT cylinders in stationary service that are filled on site at the point of use and, therefore, are not under the jurisdiction of DOT shall comply with one of the following criteria:

(1) They shall be requalified in accordance with DOT requirements.
(2) They shall be visually inspected within 12 years of the date of manufacture and within every 5 years thereafter, in accordance with 5.2.3.2 through 5.2.3.4.

5.2.3.2 Any cylinder that fails one or more of the criteria in 5.2.3.4 shall not be refilled or continued in service until the condition is corrected.

5.2.3.3 Personnel shall be trained and qualified to perform inspections. Training shall be documented in accordance with Section 4.4.

5.2.3.4 Visual inspection shall be performed in accordance with the following:

(1) The cylinder is checked for exposure to fire, dents, cuts, digs, gouges, and corrosion according to CGA C-6, *Standard for Visual Inspection of Steel Compressed Gas Cylinders*, except that 5.2.1.1(1) of that standard (which requires tare weight verification) shall not be part of the required inspection criteria.
(2) The cylinder protective collar (where utilized) and the foot ring are intact and are firmly attached.
(3) The cylinder is painted or coated to minimize corrosion.
(4) The cylinder pressure relief valve indicates no visible damage, corrosion of operating components, or obstructions.
(5) There is no leakage from the cylinder or its appurtenances that is detectable without the use of instruments.
(6) The cylinder is installed on a firm foundation and is not in contact with the soil.
(7) A cylinder that passes the visual examination is marked with the month and year of the examination followed by the letter E (e.g., "10-01E," indicating requalification in October 2001 by the external inspection method).
(8) The results of the visual inspection are documented, and a record of the inspection is retained for a 5-year period.

5.2.4 Container Service Pressure.

5.2.4.1 The service pressure of cylinders shall be in accordance with the regulations published under 49 CFR, "Transportation."

5.2.4.2 The maximum allowable working pressure (MAWP) for ASME containers shall be in accordance with Table 5.2.4.2.

5.2.4.3 In addition to the applicable provisions for horizontal ASME containers, vertical ASME containers over 125 gal (0.5 m^3) water capacity shall comply with 5.2.4.3(A) through 5.2.4.3(E).

(A) Containers shall be designed to be self-supporting without the use of guy wires and shall be designed to withstand the wind, seismic (earthquake) forces, and hydrostatic test loads anticipated at the site.

(B) The MAWP *(see Table 5.2.4.2)* shall be the pressure at the top head, with allowance made for increased pressure on lower shell sections and bottom head due to the static pressure of the product.

(C) Wind loading on containers shall be based on wind pressures on the projected area at various height zones above ground in accordance with ASCE 7, *Minimum Design Loads for Buildings and Other Structures.* Wind speeds shall be based on a mean occurrence interval of 100 years.

(D) Seismic loading on containers shall be in accordance with ASCE 7, *Minimum Design Loads for Buildings and Other Structures.* A seismic analysis of the proposed installation shall be made that meets the approval of the authority having jurisdiction.

(E) Shop-fabricated containers shall be fabricated with lifting lugs or other means to lift the container.

5.2.4.4 ASME engine fuel containers shall have a MAWP of 312 psig (2.2 MPag).

Table 5.2.4.2 Maximum Vapor Pressure and Maximum Allowable Working Pressure (MAWP)

Maximum Vapor Pressure		MAWP					
		Current ASME Code[a]		Earlier Codes			
				API-ASME		ASME[b]	
At 100°F (psig)	At 37.8°C (MPag)	psig	MPag	psig	MPag	psig	MPag
80	0.6	100	0.7	100	0.7	80	0.6
100	0.7	125	0.9	125	0.9	100	0.7
125	0.9	156	1.1	156	1.1	125	0.9
150	1.0	187	1.3	187	1.3	150	1.0
175	1.2	219	1.5	219	1.5	175	1.2
215	1.5	250	1.7[c]	250	1.7[c]	200	1.4
215	1.5	312	2.2[c]	312	2.2[c]	—	—

Note: See Annex D for information on earlier ASME or API-ASME codes.
[a]ASME Code, 1949 edition, paragraphs U-200 and U-201, and all later editions. *(See D.2.1.5.)*
[b]All ASME codes up to the 1946 edition and paragraphs U-68 and U-69 of the 1949 edition. *(See D.2.1.5.)*
[c]See 5.2.4.4 and 5.2.4.5 for required MAWP for ASME engine fuel and mobile containers.

5.2.4.5* ASME mobile containers shall be in accordance with one of the following:

(1) A MAWP of 312 psig (2.2 MPag) or higher where installed in enclosed spaces of vehicles
(2) A MAWP of 312 psig (2.2 MPag) where installed outside of passenger vehicles
(3) A MAWP of 250 psig (1.7 MPag) where installed outside of nonpassenger vehicles

5.2.4.6 Cylinders shall be designed and constructed for at least a 240 psig (1.6 MPag) service pressure.

5.2.5 ASME Container Openings.

5.2.5.1 ASME containers shall be equipped with openings for the service for which the container is to be used.

5.2.5.2 The openings required by 5.2.5.1 shall be located either in the shell, in the heads, or in a manhole cover.

5.2.5.3* ASME containers of more than 30 gal through 2000 gal (0.1 m^3 through 7.6 m^3) water capacity that are designed to be filled volumetrically shall be equipped for filling into the vapor space.

5.2.5.4* ASME containers of 126 gal through 4000 gal (0.5 m^3 through 15.2 m^3) water capacity in other than bulk plant and industrial occupancies shall be provided with an opening for an actuated liquid withdrawal excess-flow valve with a connection not smaller than ¾ in. (19 mm) national pipe thread (NPT).

5.2.5.5* ASME containers of more than 4000 gal (15.2 m^3) water capacity shall have an opening for a pressure gauge.

5.2.5.6 ASME containers in storage or use shall have pressure relief valve connections that have direct communication with the vapor space of the container.

(A) If the pressure relief valve is located in a well inside the ASME container with piping to the vapor space, the design of the well and piping shall have a flow capacity equal to or greater than that of the pressure relief valve.

(B) An enclosure that protects a pressure relief valve shall be painted, coated, or made from corrosion-resistant materials.

(C) The design of an enclosure that protects a pressure relief valve shall permit inspection of the pressure relief valve.

(D) If the pressure relief valve is located in any position other than the uppermost point of the ASME container, the connection shall be internally piped to the uppermost point practical in the vapor space of the container.

5.2.5.7* ASME containers to be filled on a volumetric basis shall be fabricated so that they can be equipped with a fixed maximum liquid level gauge(s) that is capable of indicating the maximum permitted filling level(s) in accordance with 7.4.2.3.

5.2.6 Portable Container Appurtenance Physical Damage Protection.

5.2.6.1 Cylinders shall incorporate protection against physical damage to cylinder appurtenances and immediate connections to such appurtenances when not in use by any of the following means:

(1) A ventilated cap
(2) A ventilated collar
(3) A cylinder valve providing inherent protection as defined by DOT in 49 CFR 173.301(h)(3)

5.2.6.2 Protection of appurtenances of portable containers, skid tanks, and tanks for use as cargo tanks of more than 1000 lb (454 kg) water capacity [nominal 420 lb (191 kg) propane capacity] shall comply with 5.2.6.2(A) through 5.2.6.2(C).

(A) Appurtenance protection from physical damage shall be provided by recessing, by protective housings, or by location on the vehicle.

(B) Appurtenance protection shall comply with the provisions under which the containers are fabricated.

(C) Appurtenance protection shall be secured to the container in accordance with the ASME code under which the container was designed and built.

5.2.7 Containers with Attached Supports.

5.2.7.1 Vertical ASME containers of over 125 gal (0.5 m^3) water capacity for use in permanent installations in stationary service shall be designed with steel supports that allow the container to be mounted on and fastened to concrete foundations or supports.

(A) Steel supports shall be designed to make the container self-supporting without guy wires and to withstand the wind and seismic (earthquake) forces anticipated at the site.

(B) Steel supports shall be protected against fire exposure with a material having a fire resistance rating of at least 2 hours.

(C) Continuous steel skirts having only one opening of 18 in. (460 mm) or less in diameter shall have 2-hour fire protection applied to the outside of the skirt.

5.2.7.2 ASME containers to be used as portable storage containers, including movable fuel storage tenders for temporary stationary service (normally not more than 12 months duration at any location), shall comply with 5.2.7.2(A) through 5.2.7.2(D).

(A) The legs or supports, or the lugs for the attachment of legs or supports, shall be secured to the container in accordance with the ASME code under which the container was designed and built.

(B) The attachment of a container to either a trailer or semitrailer running gear, or the attachments to the container to make it a vehicle, so that the unit can be moved by a conventional over-the-road tractor, shall comply with the DOT requirements for cargo tank service.

(C) The unit specified in 5.2.7.2(B) shall be approved for stationary use.

(D) Movable fuel storage tenders shall be secured to the trailer support structure for the service involved.

5.2.7.3 Portable tank design and construction of a full framework, skids, or lugs for the attachment of skids, and protection of fittings shall be in accordance with DOT portable tank specifications. The bottom of the skids shall be not less than 2 in. (51 mm) or more than 12 in. (300 mm) below the outside bottom of the tank shell.

5.2.8 Container Marking.

5.2.8.1 Cylinders shall be marked as provided in the regulations, rules, or code under which they are fabricated.

(A) Where LP-Gas and one or more other compressed gases are to be stored or used in the same area, the cylinders shall be marked "Flammable" and either "LP-Gas," "Propane," or "Butane," or shall be marked in accordance with the requirements of 49 CFR, "Transportation."

(B) When being transported, cylinders shall be marked and labeled in accordance with 49 CFR, "Transportation."

5.2.8.2* Cylinders shall be marked with the following information:

(1) Water capacity of the cylinder in pounds
(2) Tare weight of the cylinder in pounds, fitted for service

5.2.8.3* The markings specified for ASME containers shall be on a stainless steel metal nameplate attached to the container, located to remain visible after the container is installed.

(A) The nameplate shall be attached in such a way as to minimize corrosion of the nameplate or its fastening means and not contribute to corrosion of the container.

(B) Where the container is buried, mounded, insulated, or otherwise covered so the nameplate is obscured, the information contained on the nameplate shall be duplicated and installed on adjacent piping or on a structure in a clearly visible location.

(C) Stationary ASME containers shall be marked with the following information:

(1) Service for which the container is designed (e.g., underground, aboveground, or both)
(2) Name and address of container supplier or trade name of container
(3) Water capacity of container in pounds or U.S. gallons
(4) MAWP in pounds per square inch
(5) Wording that reads "This container shall not contain a product that has a vapor pressure in excess of ___ psig at 100°F" *(see Table 5.2.4.2)*
(6) Outside surface area in square feet
(7) Year of manufacture
(8) Shell thickness and head thickness
(9) OL (overall length), OD (outside diameter), and HD (head design)
(10) Manufacturer's serial number
(11) ASME Code symbol
(12) Minimum design metal temperature ___°F at MAWP ___ psi
(13) Type of construction "W"
(14) Degree of radiography "RT-___"

(D) In addition to the markings required by this code, nameplates on cargo tanks shall include the markings required by the ASME Code and the DOT.

5.2.8.4 Warning labels shall meet the following requirements:

(1) Warning labels shall be applied to all cylinders of 100 lb (45.4 kg) propane capacity or less that are not filled on-site.
(2) Warning labels shall include information on the potential hazards of LP-Gas.

5.2.8.5 All containers that contain unodorized LP-Gas products shall be marked "NOT ODORIZED".

(A) The marking shall have a contrasting background surrounded by a rectangular border in red letters and red border in the sizes shown in Table 5.2.8.5(A).

(B) The markings shall be on both ends or on both sides of a container or on both sides and the rear of cargo tanks.

5.3 Reserved.

5.4 Reserved.

Table 5.2.8.5(A) "NOT ODORIZED" Label Size

Water Capacity		Letter Height		Border Width	
gal	m^3	in.	cm	in.	cm
≥499	≥1.89	4	10.0	½	1.3
49–498	0.19–1.88	1½	3.7	5/16	0.8
2.6–48	0.01–0.18	¾	1.8	¼	0.6
1–2.5	0.004–0.009	⅜	1.0	1/16	0.2

5.5 Reserved.

5.6 Reserved.

5.7 Container Appurtenances and Regulators.

5.7.1 Materials.

5.7.1.1 Container appurtenances and regulators shall be fabricated of materials that are compatible with LP-Gas and shall be resistant to the action of LP-Gas under service conditions.

(A) The following materials shall not be used:

(1) Gray cast-iron
(2) Nonmetallic materials, for bonnets or bodies of valves or regulators

5.7.1.2* Pressure-containing metal parts of appurtenances shall have a minimum melting point of 1500°F (816°C), except for the following:

(1) Fusible elements
(2) Approved or listed variable liquid level gauges used in containers of 3500 gal (13.2 m^3) water capacity or less

5.7.1.3 Container appurtenances shall have a service pressure of at least 250 psig (1.7 MPag).

5.7.1.4 Gaskets used to retain LP-Gas in containers shall be resistant to the action of LP-Gas.

(A) Gaskets shall be made of metal or other material confined in metal having a melting point over 1500°F (816°C) or shall be protected against fire exposure.

(B) When a flange is opened, the gasket shall be replaced.

(C) Aluminum O-rings and spiral-wound metal gaskets shall be permitted.

(D) Gaskets for use with approved or listed liquid level gauges for installation on a container of 3500 gal (13.2 m^3) water capacity or less shall be exempt from the minimum melting point requirement.

5.7.2 Pressure Relief Devices. See Section 5.13 for hydrostatic relief valves.

5.7.2.1 ASME containers shall be equipped with one or more pressure relief valves that are designed to relieve vapor.

5.7.2.2 Cylinders shall be equipped with pressure relief valves as required by DOT regulations.

5.7.2.2.1 The rated flow capacity of the pressure relief valve (CG-7) shall meet the requirements for a liquefied gas as defined in CGA S-1.1, *Pressure Relief Device Standards, Part 1 — Cylinders for Compressed Gases.*

5.7.2.3 Cylinders shall not be solely equipped with C-2 or CG-3 fusible plugs as defined in CGA S-1.1, *Pressure Relief Device Standards, Part 1 — Cylinders for Compressed Gases.*

5.7.2.3.1 A composite cylinder shall be permitted to be equipped with a combination device containing a pressure relief valve (CG-7) with 212°F (100°C) fuse metal (CG-3).

5.7.2.4 DOT nonrefillable metal containers shall be equipped with a pressure relief device(s) or system(s) that prevents propulsion of the container when the container is exposed to fire.

5.7.2.5 ASME containers for LP-Gas shall be equipped with direct spring-loaded pressure relief valves conforming with the applicable requirements of ANSI/UL 132, *Standard for Safety Relief Valves for Anhydrous Ammonia and LP-Gas,* or other equivalent pressure relief valve standards.

(A) The start-to-leak setting of the pressure relief valves specified in 5.7.2.5, in relation to the pressure rating of the container, shall be in accordance with Table 5.7.2.5(A).

Table 5.7.2.5(A) Start-to-Leak Pressure Settings of Pressure Relief Valves in Relation to Container Pressure Rating

Containers	Minimum (%)	Maximum (%)
All ASME codes prior to the 1949 edition, and the 1949 edition, paragraphs U-68 and U-69	110	125*
ASME Code, 1949 edition, paragraphs U-200 and U-201, and all ASME codes later than 1949	100	100*

*Manufacturers of pressure relief valves are allowed a plus tolerance not exceeding 10 percent of the set pressure marked on the valve.

(B) Containers of 40,000 gal (151 m^3) or more water capacity shall be equipped with either a spring-loaded pressure relief valve or a pilot-operated pressure relief valve, as follows:

(1) The pilot-operated relief valve shall be combined with, and controlled by, a self-actuated, direct, spring-loaded pilot valve that complies with Table 5.7.2.5(A).
(2) The use of a pilot-operated pressure relief valve shall be approved.
(3) Pilot-operated pressure relief valves shall be inspected and maintained by persons with training and experience and shall be tested for operation at intervals not exceeding 5 years.

5.7.2.6 The minimum rate of discharge of pressure relief valves installed in ASME containers shall be in accordance with Table 5.7.2.6 or shall be calculated using the following formula:

$$F = 53.632 \times A^{0.82}$$

where:
F = flow rate (SCFM air)
A = total outside surface area of container (ft^2)

5.7.2.7 Relief valves for aboveground ASME containers shall relieve at not less than the flow rate specified in 5.7.2.6 before the pressure exceeds 120 percent of the minimum permitted start-to-leak pressure setting of the device, excluding the 10 percent tolerance in Table 5.7.2.5(A).

Table 5.7.2.6 Pressure Relief Valve Flow Capacity as Function of Container Surface Area

Surface Area (ft^2)	Flow Rate (SCFM)	Surface Area (ft^2)	Flow Rate (SCFM)	Surface Area (ft^2)	Flow Rate (SCFM)
≤20	626	170	3620	600	10,170
25	751	175	3700	650	10,860
30	872	180	3790	700	11,550
35	990	185	3880	750	12,220
40	1100	190	3960	800	12,880
45	1220	195	4050	850	13,540
50	1330	200	4130	900	14,190
55	1430	210	4300	950	14,830
60	1540	220	4470	1000	15,470
65	1640	230	4630	1050	16,100
70	1750	240	4800	1100	16,720
75	1850	250	4960	1150	17,350
80	1950	260	5130	1200	17,960
85	2050	270	5290	1250	18,570
90	2150	280	5450	1300	19,180
95	2240	290	5610	1350	19,780
100	2340	300	5760	1400	20,380
105	2440	310	5920	1450	20,980
110	2530	320	6080	1500	21,570
115	2630	330	6230	1550	22,160
120	2720	340	6390	1600	22,740
125	2810	350	6540	1650	23,320
130	2900	360	6690	1700	23,900
135	2990	370	6840	1750	24,470
140	3080	380	7000	1800	25,050
145	3170	390	7150	1850	25,620
150	3260	400	7300	1900	26,180
155	3350	450	8040	1950	26,750
160	3440	500	8760	2000	27,310
165	3530	550	9470	—	—

For SI units, 1 ft^2 = 0.0929 m^2; 1 SCFM = 0.0283 m^3/min.
Note: Flow rate in SCFM air.

5.7.2.8 The flow capacity of pressure relief valves installed on underground or mounded containers shall be a minimum of 30 percent of the flow specified in Table 5.7.2.6.

5.7.2.9 Each pressure relief valve shall be plainly and permanently marked with the following:

(1) Pressure in psig (MPag) at which the valve is set to start-to-leak
(2) Rated relieving capacity in SCFM (m^3/min)air
(3) Manufacturer's name and catalog number

5.7.2.10 Shutoff valves shall not be installed between pressure relief devices and the container unless a listed pressure relief valve manifold meeting the requirements of 6.7.2.9 is used.

5.7.2.11 Pressure relief valves shall be designed to minimize the possibility of tampering.

5.7.2.12 Externally set or adjusted valves shall be provided with an approved means of sealing the adjustment.

5.7.2.13 Where used on aboveground ASME containers of 1200 gal (4.5 m^3) or less water capacity in addition to spring-loaded pressure relief valves, fusible plugs shall meet the following criteria:

(1) They shall have a yield point between 208°F and 220°F (98°C and 104°C).
(2) They shall have a total discharge area not exceeding 0.25 $in.^2$ (1.6 cm^2).
(3) They shall communicate directly with the vapor space of the container.

5.7.2.14 All cylinders used in industrial truck service (including forklift truck cylinders) shall have the cylinder's pressure relief valve replaced by a new or unused valve within 12 years of the date of manufacture of the cylinder and every 10 years thereafter.

5.7.3 Overfilling Prevention Devices.

5.7.3.1 Cylinders with 4 lb through 40 lb (1.8 kg through 18 kg) propane capacity for vapor service shall be equipped or fitted with a listed overfilling prevention device that complies with ANSI/UL 2227, *Standard for Overfilling Prevention Devices*, and a fixed maximum liquid level gauge. These devices shall be either separate components or combined in the container valve assembly.

5.7.3.2* Cylinders requalified after September 30, 1998, shall be equipped with a listed overfilling prevention device and a fixed maximum liquid level gauge, sized in accordance with 7.4.3.2(A) or Table 5.7.3.2, prior to being filled.

Table 5.7.3.2 Recommended Dip Tube Lengths for Various Cylinders

Propane Cylinder Size (lb)	Material	Cylinder I.D. (in.)	Cylinder Water Capacity (lb)	Dip Tube Lengths for Various Cylinders (in.)
4.25	Steel	8.9	10.2	2.2
5	Steel	7.8	11.9	3.0
6	Steel	7.5	15.5	3.2
10	Steel	8.9	26.1	3.6
11	Steel	8.9	26.2	3.6
11	Steel	12.0	26.2	3.0
11.5	Steel	12.0	27.3	3.2
20	Steel	12.0	47.6	4.0
25	Steel	12.0	59.7	4.8
30	Steel	12.0	71.5	4.8
40	Steel	12.0	95.3	6.5
6	Aluminum	6.0	15.0	4.8
10	Aluminum	10.0	23.6	4.0
20	Aluminum	12.0	47.6	4.8
30	Aluminum	12.0	71.5	6.0
40	Aluminum	12.0	95.2	7.0

For SI units, 1 lb = 0.454 kg; 1 in. = 25 mm.
Note: This table indicates the approximate fixed maximum liquid level gauge dip tube lengths to be used for retrofitting cylinders with valves incorporating an overfilling prevention device. This table does not cover every cylinder design or configuration. If the dip tube length that is marked on the cylinder does not appear in Table 5.7.3.2, the next longer dip tube shown in the table should be used.

5.7.3.3 Cylinders required to have an overfilling prevention device (OPD) shall not be filled unless they are equipped with this device and a fixed maximum liquid level gauge. The length of the fixed maximum liquid level gauge dip tube shall be in accordance with 7.4.3.2(A) or Table 5.7.3.2.

5.7.3.4 Cylinders required to have an overfilling prevention device installed shall be equipped with either a CGA connection number 791 or a CGA connection number 810 as described in CGA V-1, *Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections.*

5.7.3.5 The following types of cylinders shall be exempt from the requirements of 5.7.3.1 through 5.7.3.4 for installing a listed overfilling prevention device:

(1) Cylinders used in industrial truck service and cylinders identified and used for industrial welding and cutting gases
(2) Cylinders manufactured prior to October 1, 1998, and designed for use in the horizontal position and where an overfilling prevention device is not available

5.7.3.6 Exempted horizontal cylinders shall be marked with a label to indicate that they are not equipped with an overfilling prevention device.

5.7.4 Container Valves and Other Appurtenances.

5.7.4.1 Containers of 4000 gal (15.2 m^3) water capacity or less shall comply with 5.7.4.1(A) through 5.7.4.1(D).

(A) Underground containers and containers originally equipped with external pressure relief valves shall be permitted to have external pressure relief valves.

(B) ASME containers having a propane capacity not greater than 100 gal (0.45 m^3) shall be permitted to have an external pressure relief valve. The external pressure relief valve shall be permitted to be part of a multiple-function valve.

(C) Containers of 2001 gal through 4000 gal (7.6 m^3 through 15.2 m^3) water capacity in bulk plant and industrial plant service shall be fitted with valves and other appurtenances in accordance with 5.7.4.2.

(D) Containers in other than bulk plant or industrial plant service shall be fitted with valves and other appurtenances in accordance with Table 5.7.4.1(D) and the following:

(1) Shutoff, filler, check, and excess-flow valves for ASME containers shall comply with ANSI/UL 125, *Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas (Other than Safety Relief).*
(2) Shutoff valves used on DOT cylinders shall comply with ANSI/UL 1769, *Standard for Cylinder Valves.*
(3) Containers of 125 gal through 4000 gal (0.5 m^3 through 15.2 m^3) water capacity shall be provided with an actuated liquid withdrawal excess-flow valve with a connection not smaller than ¾ in. NPT (19 mm), and the container connection shall not be smaller than ¾ in. NPT (19 mm).
(4) An actuated liquid withdrawal excess-flow valve shall not be required on container connections equipped for liquid withdrawal with a positive shutoff valve that is located as close to the container as practical in combination with an excess-flow valve installed in the container connection.
(5) The actuated liquid withdrawal excess-flow valve shall not be connected for continuous use unless the valve is recommended by the manufacturer for such service.

Table 5.7.4.1(D) Container Connection and Appurtenance Requirements for Containers Used in Other Than Bulk Plants and Industrial Plants

Part	Appurtenance	1 Cylinders 2 lb Through 420 lb Propane Capacity	2 Stationary ASME Containers ≤4000 gal Water Capacity[a]	3 DOT and ASME Engine Fuel and Mobile Containers
A	Vapor shutoff valve[b]	R (CGA 555 outlet prohibited)	R	R with internal excess-flow valve
B	Liquid shutoff valve[b]	R with CGA 555 outlet and internal excess-flow valve	R with internal excess flow valve	R with internal excess-flow valve
D	Pressure relief valve	R *(See 5.7.2.2.)*	R[c] *[See 5.7.4.1(B).]*	R with full internal or flush-type full internal pressure relief valve
E	Fixed maximum liquid level gauge	R (filled by volume) R (filled by weight, ≤40 lb and >100 lb) *[See 5.7.4.1(D)(10).]*	R	R
F	Overfilling prevention device	R (4 lb through 40 lb) *(See 5.7.3.)*	NR	R (ASME only) *[See 5.7.4.1(D)(6).]*
G	Actuated liquid withdrawal excess-flow valve	NR	R (≥125 gal) *[See 5.7.4.1(D)(3), (4), and (5).]*	NR
H	Float gauge	NR	R (>124 gal only)	NR
I	Filler valve *[See 5.7.4.1(D)(7).]*	R (for ≥100 lb cylinders that are filled on site at the point of use)	R	R (for ASME containers only)

For SI units, 1 lb = 0.454 kg; 1 gal = 0.0045 m^3.

R: Required. NR: Not required.

[a]All ASME container capacities are water capacity.

[b]Where installed.

[c]Aboveground ASME containers, internal spring-type pressure relief valves only, except as stated in 5.7.4.1(A) and 5.7.4.1(B).

(6) An overfilling prevention device shall not be required for engine fuel cylinders used on industrial (and fork-lift) trucks powered by LP-Gas or for engine fuel cylinders used on vehicles (including floor maintenance machines) having LP-Gas–powered engines mounted on them.

(7) A filler valve shall incorporate one of the following:
   (a) Double backflow check valves of the spring-loaded type
   (b) Manual shutoff valve with an internal backflow check valve of the spring-loaded type
   (c) Combination single backflow check valve of the spring-loaded type and an overfilling prevention device designed for containers

(8) Manual shutoff valves in vapor service shall be equipped with one of the following:
   (a) Orifice between the container contents and the shutoff valve outlet, not exceeding 5/16 in. (8 mm) in diameter, and an approved regulator directly attached, or attached with a flexible connector, to the manual shutoff valve outlet
   (b) Excess-flow valve

(9) Overfilling prevention devices shall be required on cylinders having 4 lb through 40 lb (1.8 kg through 18 kg) propane capacity for vapor service. *(See 5.7.3.)*

(10) Cylinders greater than 40 lb through 100 lb (18 kg through 45 kg) propane capacity filled by volume shall have a fixed maximum liquid level gauge.

(11) Pressure relief valves installed in multiple function valves in single opening cylinders used in industrial truck service shall have the springs and guiding mechanism on the container pressure side of the seats, so that the springs and guiding mechanism shall not be exposed to the atmosphere.

(12) Multiple function valves installed on single opening cylinders used in industrial truck service shall meet the following requirements:

(a) When required by 5.7.2.14, the multiple function valve in accordance with 5.7.2.14 shall have the pressure relief valve exchanged with a replacement multiple function valve that incorporates the pressure relief valve described in 5.7.4.1(D)(11).

(b) The multiple function valve pressure relief valve shall be permitted to have the means to be replaced without removing the multiple function valve from the cylinder.

(c) The multiple function valve shall incorporate an internal excess-flow valve for the liquid or vapor withdrawal service valve outlet.

(d) The multiple function valve shall incorporate a weak section on the service valve outlet connection.

(e) The multiple function valve shall incorporate an internal excess-flow valve that shall not restrict the flow to the pressure relief valve.

(f) The multiple function valve shall be listed.

5.7.4.2 ASME containers greater than 4000 gal (15.2 m^3) water capacity shall be fitted with valves and other appurtenances in accordance with 5.7.4.2(A) through 5.7.4.2(I) and Table 5.7.4.2.

(A) Vapor withdrawal openings shall be equipped with either of the following:

(1) A positive shutoff valve located as close to the container as practical in combination with an excess-flow valve installed in the container

(2) An internal valve

(B) Liquid withdrawal openings in new installations shall be equipped with an internal valve that is fitted for remote closure and automatic shutoff using thermal (fire) actuation where the thermal element is located within 5 ft (1.5 m) of the internal valve.

Table 5.7.4.2 Connection and Appurtenance Requirements for New and Existing Container Installations in Bulk Plants and Industrial Plants

Service	2001 gal through 4000 gal W.C.* (7.6 m^3 through 15.2 m^3)	Greater Than 4000 gal W.C.* (>15.2 m^3)	Requirements for Containers of Greater Than 4000 gal W.C. (>15.2 m^3) With and Without Internal Valves†	
			Without Existing Internal Valves (by 7/1/11)	With Existing Internal Valves
Vapor inlet	Option A, Option B, or Option C	Option A, Option B, or Option C	See Note	See Note
Vapor outlet	Option B or Option C	Option B or Option C	See Note	See Note
Liquid inlet	Option A, Option B, or Option C	Option D or Option E	Option D, Option E, Option F, or Option G	RT
Liquid outlet	Option B or Option C	Option E	Option E or Option H	RT

Option A: Positive shutoff valve installed as close as practical to a backflow check valve installed in the container.

Option B: Positive shutoff valve installed as close as practical to an excess-flow valve installed in the container and sized in accordance with 5.7.8.1(H).

Option C: Internal valve installed in the container or an excess-flow valve in accordance with 5.7.4.2(I).

Option D: Positive shutoff valve installed as close as practical to a backflow check valve designed for the intended application and installed in the container.

Option E: Internal valve installed in the container equipped for remote closure and automatic shutoff using thermal (fire) activation within 5 ft (1.5 m) of valve or an excess-flow valve in accordance with 5.7.4.2(I).

Option F: Emergency shutoff valve equipped for remote closure and automatic shutoff using thermal (fire) activation installed in the line upstream as close as practical to an existing positive shutoff valve/excess-flow valve combination.

Option G: Backflow check valve designed for the intended application and installed in the line upstream as close as practical to the existing positive shutoff valve/excess-flow valve combination.

Option H: Emergency shutoff valve equipped for remote closure and automatic shutoff using thermal (fire) activation, installed in the line downstream as close as practical to an existing positive shutoff valve/excess-flow valve combination.

RT: Equipping an existing internal valve for remote closure and automatic shutoff using thermal (fire) actuation within 5 ft (1.5 m) of the internal valve.

Note: Vapor connections on containers installed prior to the effective date of the 2001 edition of NFPA 58 are not required to be modified.

*Applicable to installations constructed on or after the effective date of this code.

†Applicable to installations constructed prior to the effective date of this code.

(C) Liquid withdrawal openings in existing installations where the container is equipped with an internal valve that is not fitted for remote closure and automatic shutoff using thermal (fire) actuation shall be equipped for remote and thermal closure by July 1, 2003.

(D) Liquid withdrawal openings in existing installations shall be equipped with either of the following by July 1, 2011:

(1) An internal valve that is fitted for remote closure and automatic shutoff using thermal (fire) actuation where the thermal element is located within 5 ft (1.5 m) of the internal valve
(2) An emergency shutoff valve that is installed in the line downstream as close as practical to a positive shutoff valve in combination with an excess-flow valve installed in the container

(E) Vapor inlet openings shall be equipped with either of the following:

(1) A positive shutoff valve that is located as close to the container as practical in combination with either a backflow check valve or an excess-flow valve installed in the container
(2) An internal valve

(F) Liquid inlet openings in new installations shall be equipped with either of the following:

(1) An internal valve that is fitted for remote closure and automatic shutoff using thermal (fire) actuation where the thermal element is located within 5 ft (1.5 m) of the internal valve
(2) A positive shutoff valve that is located as close to the container as practical in combination with a backflow check valve that is designed for the intended application and is installed in the container

(G) Liquid inlet openings in existing installations where the container is equipped with an internal valve that is not fitted for remote closure and automatic shutoff using thermal (fire) actuation shall be equipped for remote and thermal closure by July 1, 2003.

(H) Liquid inlet openings in existing installations shall be equipped with any of the following by July 1, 2011:

(1) An internal valve that is fitted for remote closure and automatic shutoff using thermal (fire) actuation where the thermal element is located within 5 ft (1.5 m) of the internal valve
(2) An emergency shutoff valve that is installed in the line upstream as close as practical to a positive shutoff valve in combination with an excess-flow valve installed in the container
(3) A positive shutoff valve that is located as close to the container as practical in combination with a backflow check valve that is designed for the intended application and is installed in the container
(4) A backflow check valve that is designed for the intended application and is installed in the line upstream as close as practical to a positive shutoff valve in combination with an excess-flow valve installed in the container

(I) Container openings that are not compatible with internal valves shall be permitted to utilize both an excess-flow valve installed in the container and a valve complying with API Standard 607, *Fire Test for Quarter-Turn Valves and Valves Equipped with Non-Metallic Seats*, with the following features:

(1) The valve shall be activated either hydraulically or pneumatically and shall fail in the closed position.
(2) The valve shall be equipped for remote closure and thermal actuation with a thermal element located within 5 ft (1.5 m) of the valve.

5.7.4.3 ASME containers of 2001 gal through 4000 gal (7.6 m^3 through 15.2 m^3) water capacity used for bulk plants and industrial plants shall be fitted with valves and other appurtenances in accordance with Table 5.7.4.2.

5.7.4.4 ASME containers over 4000 gal (15.2 m^3) water capacity shall also be equipped with the following appurtenances:

(1) An internal spring-type, flush-type full internal pressure relief valve, or external pressure relief valve *(see Annex E)*
(2) A fixed maximum liquid level gauge
(3) A float gauge, rotary gauge, slip tube gauge, or a combination of these gauges
(4) A pressure gauge
(5) A temperature gauge

5.7.4.5 The appurtenances specified in Table 5.7.4.1(D) and 5.7.4.3 shall comply with the following:

(1) Manual shutoff valves shall be designed to provide positive closure under service conditions.
(2) Excess-flow check valves shall be designed to close automatically at the rated flows of vapor or liquid specified by the manufacturer.
(3) Excess-flow valves shall be designed with a bypass that shall not exceed a No. 60 drill size opening to allow equalization of pressure.
(4) Excess-flow valves of less than ½ in. NPT (13 mm) shall have a bypass that limits propane vapor flow to 10 scf/hr at 100 psig (690 kPag).
(5) Backflow check valves shall be of the spring-loaded or weight-loaded type with in-line or swing operation and shall close when the flow is either stopped or reversed.
(6) Internal valves *(see 3.3.75.6, Internal Valve)*, either manually or remotely operated and designed to remain closed except during operating periods, shall be considered positive shutoff valves.

5.7.5 Liquid Level Gauging Devices.

5.7.5.1 Liquid level gauging devices shall be installed on all containers filled by volume.

5.7.5.2 The gauging devices shall be either fixed maximum liquid level gauges or variable gauges of the slip tube, rotary, or float type (or combinations of such gauges).

5.7.5.3* Every container designed to be filled on a volumetric basis shall be equipped with a fixed maximum liquid level gauge(s) to indicate the maximum filling level(s) for the service(s) in which the container is to be filled or used. *(See 7.4.3.3.)*

5.7.5.4 ASME containers shall have permanently attached to the container adjacent to the fixed maximum liquid level gauge, or on the container nameplate, markings showing the percentage of capacity that is indicated by that gauge.

5.7.5.5 Cylinders shall have the letters DT stamped on them followed by the vertical distance (to the nearest tenth of an inch), measured from the top of the boss or coupling into which the gauge, or the cylinder valve of which it is a part, is installed to the end of the dip tube.

5.7.5.6 Cylinders equipped with a fixed maximum liquid level gauge where the dip tube is not welded to the inside of the cylinder shall be permanently marked adjacent to the gauge.

(A) Cylinders designed to be filled in one position shall be marked as follows:

(1) The marking shall be the letters DT followed by the dip tube length to the nearest tenth of an inch.
(2) The dip tube length shall be measured from the top center of the cylinder boss or coupling where the gauge is installed to the maximum permitted filling level.

(B) Universal cylinders, where the dip tube is not welded to the inside of the cylinder and that are permitted to be filled in either the vertical or horizontal position, shall be marked as follows:

(1) Vertical filling: With the letters VDT followed by the vertical distance (to the nearest tenth of an inch), measured from the top center of the coupling where the gauge is installed to the maximum permitted filling level
(2) Horizontal filling: With the letters HDT followed by the vertical distance (to the nearest tenth of an inch), measured from the centerline of the coupling opening into which the gauge is installed located at the maximum filling level in the horizontal position, to the inside top of the cylinder

5.7.5.7 Cargo tanks and ASME containers utilizing multiple fixed liquid level gauges shall have the loading percentage (to the nearest 9/10 percent) stamped adjacent to each gauge.

5.7.5.8 Variable liquid level gauges shall comply with 5.7.5.8(A) through 5.7.5.8(D).

(A) Variable liquid level gauges installed on containers over 1200 gal (4.5 m^3) water capacity shall be marked with the maximum liquid level, in inches, metric units, or percent of capacity of the container on which they are to be installed.

(B) If temperature correction markings are provided on variable liquid level gauges on containers greater than 1200 gal (4.5 m^3) that will be used for volumetric filling as allowed by 7.4.3.2(A), 7.4.3.2(B), and 7.4.3.3, the markings shall indicate the maximum liquid level at liquid temperatures in accordance with Table 7.4.2.3(b) or Table 7.4.2.3(c). Temperature markings shall be from 20°F to 115°F (–6.7°C to 46°C), with increments not to exceed 20°F (11°C) for propane, for 50/50 butane–propane mixtures, and for butane.

(C) Dials of magnetic float gauges or rotary gauges shall indicate whether they are for cylindrical or spherical ASME containers and whether they are for aboveground or underground service.

(D) The dials of gauges for use only on aboveground containers of over 1200 gal (4.5 m^3) water capacity shall be so marked.

5.7.5.9 Variable liquid level gauges shall comply with the provisions of 7.4.3.2(B) if they are used for filling containers.

5.7.5.10 Gauging devices that vent product to the atmosphere when used shall be designed so that the vent valve maximum opening to the atmosphere is not larger than a No. 54 drill size.

5.7.6 Pressure Gauges.

5.7.6.1 Pressure gauges shall be attached directly to the container opening or to a valve or fitting that is directly attached to the container opening.

5.7.6.2 If the cross-sectional area of the opening into the container described in 5.7.6.1 is greater than that of a No. 54 drill size, an excess-flow check valve shall be provided for the container connection.

5.7.7 Other Container Connections.

5.7.7.1 Other container openings shall be equipped with any of the following:

(1) Positive shutoff valve in combination with either an excess-flow check valve or a backflow check valve
(2) Internal valve
(3) Backflow check valve
(4) Actuated liquid withdrawal excess-flow valve, normally closed and plugged, with provision to allow for external actuation
(5) Plug, blind flange, or plugged companion flange

5.7.7.2 Any of the valves listed in 5.7.7.1(1), (2), or (3) that are not connected for service shall be plugged or capped.

5.7.8 Container Appurtenance Installation.

5.7.8.1 All container openings except those used for pressure relief devices, liquid level gauging devices, pressure gauges, filler valves, combination backflow check and excess-flow vapor return valves, actuated liquid withdrawal excess-flow valves, and plugged openings shall be equipped with internal valves or with positive shutoff valves and either excess-flow or backflow check valves.

(A) Valves in ASME containers, where excess-flow or backflow check valves are installed between the LP-Gas in the container and the shutoff valves, shall be installed either inside the container or at a point immediately outside where the line enters or leaves the container.

(B) If excess-flow and backflow check valves are installed outside the container, installation shall be made so that any strain beyond the excess-flow or backflow check valves will not cause breakage between the container and the valve.

(C) All connections that are listed in the ASME Manufacturers' Data Report for the container shall be considered part of the container.

(D) If an excess-flow valve is required for cylinders other than for mobile or engine fuel service, it shall be permitted to be located at the outlet of the cylinder shutoff valve.

(E) Shutoff valves shall be located as close to the container as practical.

(F) Shutoff valves shall be readily accessible for operation and maintenance under normal and emergency conditions.

(G) Shutoff valves either shall be located in a readily accessible position less than 6 ft (1.8 m) above ground level; shall have extension handles, stairs, ladders, or platforms for access; or shall be equipped for remote operation.

(H) The connection or line that leads to or from any individual opening shall have a flow capacity greater than the rated flow of the excess-flow valve protecting the opening.

5.7.8.2 Valves, regulators, gauges, and other container appurtenances shall be protected against physical damage.

5.7.8.3 Valves and other appurtenances that are part of the assembly of portable multicylinder systems shall be arranged so that replacement of cylinders can be made without shutting off the flow of gas in the system.

5.7.8.4 Connections to ASME containers installed underground shall be located within a dome, housing, or manhole and shall have a cover.

(A)* Underground containers shall be installed so that all connections for hose and the point of discharge from pressure relief devices are located above the normal maximum water table.

(B) Such manholes or housings shall be ventilated.

(C) The area of ventilation openings shall equal or exceed the combined discharge areas of the pressure relief devices and other vent lines that discharge into the manhole or housing.

5.7.8.5 Container inlet and outlet connections on ASME containers of more than 2000 gal (7.6 m^3) water capacity shall be labeled either on the container service valve or on the container to designate whether they communicate with the vapor or liquid space.

5.7.8.6 Connections for pressure relief devices, liquid level gauging devices, and pressure gauges shall not be required to be labeled.

5.7.8.7 Every ASME storage container of more than 2000 gal (7.6 m^3) water capacity shall be provided with a pressure gauge.

5.7.9* **Container Refurbishment.** To prevent the intrusion of foreign matter and physical damage during the container refurbishment process, either of the following shall be required:

(1) The container appurtenances shall be removed and the container openings shall be protected.
(2) The container appurtenances shall be protected.

5.8 Regulators and Regulator Vents.

5.8.1 Regulators.

5.8.1.1 Pressure regulators with a maximum rated capacity of 500,000 Btu/hr (147 kW/hr), except for line pressure and appliance regulators, shall comply with ANSI/UL 144, *Standard for LP-Gas Regulators*. Line pressure regulators shall comply with ANSI Z21.80/CSA 6.22, *Standard for Line Pressure Regulators*. Appliance pressure regulators shall comply with ANSI Z21.18/CSA 6.3, *Gas Appliance Regulators*.

5.8.1.2 Regulators over 500,000 Btu/hr (147 kW/hr) capacity shall be recommended by the manufacturer for use with LP-Gas.

5.8.1.3 Single-stage regulators shall have a maximum outlet pressure setting of 1.0 psig (7 kPag) and shall be equipped with one of the following *(see 6.8.1.4 for required protection from the elements)*:

(1) Integral pressure relief valve on the outlet pressure side having a start-to-discharge pressure setting within the limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*
(2) Integral overpressure shutoff device that shuts off the flow of LP-Gas vapor when the outlet pressure of the regulator reaches the overpressure limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*, and does not open to allow flow of gas until it has been manually reset

5.8.1.4 Second-stage regulators and integral two-stage regulators shall be equipped with one of the following *(see 6.8.1.4 for required protection from the elements)*:

(1) An integral pressure relief valve on the outlet pressure side having a start-to-discharge pressure setting within the limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*, that limits the outlet pressure of the second-stage regulator to 2.0 psig (14 kPag) or less when the regulator seat disc is removed and the inlet pressure to the regulator is 15.0 psig (103.5 kPag), as specified in ANSI/UL 144, *Standard for LP-Gas Regulators*
(2) An integral overpressure shutoff device that shuts off the flow of LP-Gas vapor when the outlet pressure of the regulator reaches the overpressure limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*, and does not open to allow flow of gas until it has been manually reset

5.8.1.5 Second-stage regulators with a rated capacity of more than 500,000 Btu/hr (147 kW/hr) shall either comply with ANSI/UL 144, *Standard for LP-Gas Regulators*, with respect to an integral pressure relief device or an overpressure shutoff device, or shall have a separate overpressure protection device complying with 5.9.2 of NFPA 54, *National Fuel Gas Code* (ANSI Z223.1). The overpressure protection devices shall limit the outlet pressure of the regulator to 2.0 psig (14 kPag) or less when the regulator seat disc is removed and the inlet pressure to the regulator is 15.0 psig (103.5 kPag).

5.8.1.6 Integral two-stage regulators shall be provided with a means to determine the outlet pressure of the high-pressure regulator portion of the integral two-stage regulator.

5.8.1.7 Automatic changeover regulators shall be exempt from the requirement in 5.8.1.6.

5.8.1.8 Integral two-stage regulators shall not incorporate an integral pressure relief valve in the high-pressure regulator portion of the unit.

5.8.1.9 First-stage regulators shall incorporate an integral pressure relief valve having a start-to-discharge setting within the limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*.

5.8.1.10 High-pressure regulators with a rated capacity of more than 500,000 Btu/hr (147 kW/hr) where permitted to be used in two-stage systems shall incorporate an integral pressure relief valve or shall have a separate relief valve.

5.8.1.11 First-stage regulators shall have an outlet pressure setting up to 10.0 psig (69 kPag) in accordance with ANSI/UL 144, *Standard for LP-Gas Regulators*.

5.8.1.12 First-stage regulators with a rated capacity of more than 500,000 Btu/hr (147 kW/hr) shall be permitted to have a separate pressure relief valve.

5.8.1.13 Regulators shall be designed to drain condensate from the regulator spring case when the vent is directed vertically down.

5.8.1.14 Two psig service regulators and integral 2 psi regulators shall have a maximum outlet pressure setting of 2.5 psi (17 kPag) and shall be equipped with one of the following:

(1) An integral pressure relief valve on the outlet pressure side having a start-to-discharge pressure setting within the limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*. This relief device shall limit the outlet pressure of the 2 psig service regulator to 5.0 psig when the seat disc is removed and the inlet pressure of the regulator is 15.0 psig (103 kPag) as specified in ANSI/UL 144, *Standard for LP-Gas Regulators*.
(2) An integral overpressure shutoff device that shuts off the flow of LP-Gas vapor when the outlet pressure of the regulator reaches the overpressure limits specified in ANSI/UL 144, *Standard for LP-Gas Regulators*. Such a device shall not open to permit the flow of LP-Gas vapor until it has been manually reset.

5.8.2 Pressure Regulators. (Reserved)

5.8.3* Pipe for Regulator Venting.

5.8.3.1 Pipe or tubing used to vent regulators shall be one of the following:

(1) Metal pipe and tubing in accordance with 5.9.3
(2) PVC conduit meeting the requirements of ANSI/UL 651, *Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings*
(3) Flexible conduit meeting the requirements of ANSI/UL 1660, *Standard for Liquid-Tight Flexible Nonmetallic Conduit*, with nonmetallic fittings meeting the requirements of ANSI/UL 514B, *Standard for Conduit, Tubing, and Cable Fittings*
(4) Flexible conduit meeting the requirement of ANSI/UL 1660, *Standard for Liquid-Tight Flexible Nonmetallic Conduit*, with metallic or nonmetallic fittings as part of a manufactured assembly

5.8.3.2 Other PVC piping materials and polyethylene and polyamide pipe and tubing shall not be permitted to be used to vent regulators.

5.9 Piping (Including Hose), Fittings, and Valves.

5.9.1 General.

5.9.1.1 Material specifications for pipe, tubing, pipe and tubing fittings, valves (including hydrostatic relief valves), hose, hose connections, and flexible connectors shall be in accordance with Section 5.9.

5.9.1.2 Piping, pipe and tubing fittings, and valves used to supply utilization equipment within the scope of NFPA 54, *National Fuel Gas Code*, shall comply with that code.

5.9.1.3 Pipe and tubing shall comply with one of the following requirements:

(1) Pipe and tubing shall comply with 5.9.3.
(2) Pipe and tubing shall be recommended for that service by the manufacturer and shall be approved.

5.9.1.4 Piping that can contain liquid LP-Gas and that can be isolated by valving and that requires hydrostatic relief valves, as specified under Section 6.13, shall have an operating pressure of 350 psig (2.4 MPag) or a pressure that is equivalent to the maximum discharge pressure of any pump or other source feeding the fixed piping system if it is greater than 350 psig (2.4 MPag).

5.9.2 Reserved.

5.9.3 Pipe and Tubing.

5.9.3.1 Pipe shall be wrought iron or steel (black or galvanized), brass, copper, polyamide, or polyethylene and shall comply with the following:

(1) Wrought iron: ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*
(2) Steel pipe: ASTM A 53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*
(3) Steel pipe: ASTM A 106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
(4) Brass pipe: ASTM B 43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*
(5) Copper pipe: ASTM B 42, *Standard Specification for Seamless Copper Pipe, Standard Sizes*
(6) Polyamide pipe: ASTM D 2513-09, *Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings*, and shall be recommended by the manufacturer for use with LP-Gas
(7) Polyethylene pipe: ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*, and shall be recommended by the manufacturer for use with LP-Gas

5.9.3.2 Tubing shall be steel, stainless steel, brass, copper, polyamide, or polyethylene *(see 6.9.4)* and shall comply with the following:

(1) Brass tubing: ASTM B 135, *Standard Specification for Seamless Brass Tube*
(2) Copper tubing:
  (a) Type K or L: ASTM B 88, *Standard Specification for Seamless Copper Water Tube*
  (b) ASTM B 280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*
(3) Polyamide tubing: ASTM D 2513-09, *Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings*, and shall be recommended by the manufacturer for use with LP-Gas
(4) Polyethylene tubing: ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*, and shall be recommended by the manufacturer for use with LP-Gas
(5) Corrugated stainless steel tubing: ANSI/CSA 6.26 (LC1), *Interior Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing*

5.9.4 Fittings for Metallic Pipe and Tubing.

5.9.4.1 Fittings shall be steel, brass, copper, malleable iron, or ductile (nodular) iron.

5.9.4.2 Pipe fittings shall have a minimum pressure rating as specified in Table 5.9.4.2 and shall comply with the following:

(1) Cast-iron pipe fittings shall not be used.
(2) Brazing filler material shall have a melting point that exceeds 1000°F (538°C).

5.9.4.3 Metal tube fittings shall have a minimum pressure rating as specified in Table 5.9.4.2.

Table 5.9.4.2 Service Pressure Rating of Pipe, Tube Fittings, and Valves

Service	Minimum Pressure
Higher than container pressure	350 psig (2.4 MPag) or the MAWP, whichever is higher, or 400 psig (2.8 MPag) water, oil, and gas (WOG) rating
LP-Gas liquid or vapor at operating pressure over 125 psig (0.9 MPag) and at or below container pressure	250 psig (1.7 MPag)
LP-Gas vapor at operating pressure of 125 psig (0.9 MPag) or less	125 psig (0.9 MPag)

5.9.5 Fittings for Polyethylene and Polyamide Pipe and Tubing.

5.9.5.1* Joints in polyamide and polyethylene pipe and polyethylene tubing shall be made by heat fusion, by compression-type mechanical fittings, or by factory-assembled transition fittings.

5.9.5.2 Polyethylene pipe shall not be joined by a threaded or miter joint.

5.9.5.3 Polyamide and polyethylene fusion fittings shall be recommended by the manufacturer for use with LP-Gas and shall conform to one of the following:

(1) ASTM D 2683, *Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing*
(2) ASTM D 3261, *Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*
(3) ASTM F 1055, *Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*
(4) ASTM F 1733, *Standard Specification for Butt Heat Fusion Polyamide (PA) Plastic Fitting for Polyamide (PA) Plastic Pipe and Tubing*

5.9.5.4 Installation instructions specific to the type and grade of polyethylene being joined shall be provided with heat fusion fittings.

5.9.5.5* Mechanical fittings shall comply with Category 1 of ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings*, and 5.9.5.5(A) through 5.9.5.5(C).

(A) Mechanical joints shall be tested and recommended by the manufacturer for use with polyethylene pipe and tubing.

(B) Compression-type mechanical fittings shall include a rigid internal tubular stiffener, other than a split tubular stiffener, to support the pipe.

(C) Gasket material in the fitting shall be resistant to the action of LP-Gas and shall be compatible with the polyamide or polyethylene pipe material.

5.9.5.6 Anodeless risers shall comply with 5.9.5.6(A) through 5.9.5.6(E).

(A) The metal-gas carrying portion of the anodeless riser after the transition shall have a wall thickness equal to Schedule 40 pipe.

(B) Factory-assembled anodeless risers shall be recommended for LP-Gas use and shall be leak tested by the manufacturer in accordance with written procedures.

(C) Field-assembled anodeless risers with service head adapters shall be equipped with moisture seals and shall be recommended for LP-Gas use by the manufacturer.

(D) Field assembled anodeless risers shall be design certified to meet the requirements of Category 1 of ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings*; U.S. Department of Transportation, 49 CFR 192.281(e), "Transportation"; and 6.9.4.3 and 6.9.4.4.

(E) The manufacturer shall provide the user qualified installation instructions as prescribed by U.S. Department of Transportation, 49 CFR 192.283(b).

5.9.6 Hose, Quick Connectors, Hose Connections, and Flexible Connectors.

5.9.6.1 Hose, hose connections, and flexible connectors *(see 3.3.25, Flexible Connector)* shall be fabricated of materials that are resistant to the action of LP-Gas both as liquid and vapor.

5.9.6.2 When wire braid is used for reinforcement, it shall be of corrosion-resistant material such as stainless steel.

5.9.6.3 Hose and quick connectors shall be approved.

5.9.6.4 Hose, hose connections, and flexible connectors used for conveying LP-Gas liquid or vapor at pressures in excess of 5 psig (34 kPag), and as provided in Section 6.20 regardless of the pressure, shall comply with 5.9.6.4(A) through 5.9.6.4(E).

(A) Hose shall be designed for a working pressure of at least 350 psig (2.4 MPag), with a safety factor of 5 to 1 and comply with ANSI/UL 569, *Standard for Pigtails and Flexible Hose Connectors for LP-Gas*, or ANSI/UL 21, *Standard for LP-Gas Hose.*

(B) Hose shall be continuously marked to provide at least the following information:

(1) LP-GAS HOSE or LPG HOSE
(2) Maximum working pressure
(3) Manufacturers' name or coded designation
(4) Month or quarter and year of manufacture
(5) Product identification

(C) Hose assemblies, after the application of couplings, shall have a design capability of not less than 700 psig (4.8 MPag).

(D) If a pressure test is performed, such assemblies shall be pressure tested at 120 percent of the maximum working pressure [350 psig (2.4 MPag) minimum] of the hose.

(E) Hose assemblies shall be leak tested at the time of installation at not less than the operating pressure of the system in which they are installed.

5.9.6.5 Hoses at a pressure of 5 psig (34 kPag) or less in agricultural buildings not normally occupied by the public shall be designed for the working pressure of the system and shall be constructed of material resistant to the action of LP-Gas.

5.9.6.6 Hoses or flexible connectors used to supply LP-Gas to utilization equipment or appliances shall be installed in accordance with the provisions of 6.9.6 and 6.21.3.

5.10 Reserved.

5.11 Internal Valves. (Reserved)

5.12 Valves Other Than Container Valves.

5.12.1 Materials.

5.12.1.1 Pressure-containing metal parts of valves shall be of steel, ductile (nodular) iron, malleable iron, or brass.

5.12.1.2 Ductile iron shall meet the requirements of ASTM A 395, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*, or equivalent.

5.12.1.3 Malleable iron shall meet the requirements of ASTM A 47, *Standard Specification for Ferritic Malleable Iron Castings*, or equivalent.

5.12.1.4 All materials used, including valve seat discs, packing, seals, and diaphragms, shall be resistant to the action of LP-Gas under service conditions.

5.12.2 Valves in Piping Systems.

5.12.2.1 Valves shall have a service pressure rating as specified in Table 5.9.4.2.

5.12.2.2 Manual shutoff valves, emergency shutoff valves, excess-flow check valves, and backflow check valves used in piping systems shall comply with the provisions for container valves. *(See 5.7.4.)*

5.12.2.3 Emergency shutoff valves shall be approved and shall incorporate all of the following means of closing:

(1) Automatic shutoff through thermal (fire) actuation
(2) Manual shutoff from a remote location
(3) Manual shutoff at the installed location

5.12.2.4 Where fusible elements are used, they shall have a melting point not exceeding 250°F (121°C).

5.12.2.5 Valves in polyethylene piping systems shall be manufactured from thermoplastic materials listed in ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings,* that have been shown to be resistant to the action of LP-Gas and comply with ASTM D 2513.

5.12.2.6 Valves in polyamide piping systems shall be manufactured from polyamide material as defined in ASTM D 2513-09, *Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.*

5.12.2.7 Metallic valves in polyethylene and polyamide piping systems shall be protected to minimize corrosion in accordance with Section 6.17.

5.12.2.8 Valves shall be recommended for LP-Gas service by the manufacturer.

5.13 Hydrostatic Relief Valves.

5.13.1 Hydrostatic relief valves designed to relieve the hydrostatic pressure that can develop in sections of liquid piping between closed shutoff valves shall have pressure settings not less than 400 psig (2.8 MPag) or more than 500 psig (3.5 MPag), unless installed in systems designed to operate above 350 psig (2.4 MPag).

5.13.2 Hydrostatic relief valves for use in systems designed to operate above 350 psig (2.4 MPag) shall have settings not less than 110 percent or more than 125 percent of the system design pressure.

5.14 Reserved.

5.15 Reserved.

5.16 Reserved.

5.17 Equipment.

5.17.1 Pressure-Containing Metal Parts.

5.17.1.1 This section shall apply to pressure-containing metal parts of LP-Gas equipment.

5.17.1.2 The service pressure rating of equipment shall be in accordance with Table 5.17.1.2.

5.17.1.3 Equipment shall be fabricated of materials that are compatible with LP-Gas under service conditions and shall be in accordance with Table 5.17.1.3.

(A) Pressure-containing metal parts shall be made from the following materials:

(1) Steel

Table 5.17.1.2 Service Pressure Rating

Fluid	Pressure	Equipment Design Pressure
LP-Gas vapor	≤20 psig (≤138 kPag)	Maximum anticipated pressure
	20 psig–125 psig (138 kPag–0.9 MPag)	125 psig (0.9 MPag)
	>125 psig (>0.9 MPag)	250 psig (1.7 MPag) or the anticipated pressure, whichever is higher
LP-Gas liquid	≤250 psig (≤1.7 MPag)	250 psig (1.7 MPag)
	>250 psig (>1.7 MPag)	350 psig (2.4 MPag) or the anticipated pressure, whichever is higher

(2) Ductile (nodular) iron (ASTM A 395, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures,* or ASTM A 536, *Standard Specification for Ductile Iron Castings,* Grade 60-40-18 or 65-45-12)
(3) Malleable iron (ASTM A 47, *Standard Specification for Ferritic Malleable Iron Castings*)
(4) Higher strength gray iron (ASTM A 48, *Standard Specification for Gray Iron Castings,* Class 40B)
(5) Brass
(6) Materials equivalent to 5.17.1.3(A)(1) through 5.17.1.3(A)(5) in melting point, corrosion resistance, toughness, and strength

(B) Cast-iron shall not be used as a material of construction for strainers or flow indicators.

(C) Aluminum shall be used only for cylinders, gaskets, regulators, approved meters, and indirect electric vaporizers.

(D) Zinc shall be used for approved regulators only, complying with ASTM B 86, *Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.*

(E) Nonmetallic materials shall not be used for upper or lower casings of regulators.

5.17.2 Pumps. Pumps shall be designed for LP-Gas service.

5.17.2.1 The maximum design pressure rating for pumps shall be based upon the maximum differential pressure produced and shall be in accordance with Table 5.17.2.1.

5.17.2.2 Pumps that produce a differential pressure greater than 125 psi (0.9 MPa) shall be marked to indicate that a bypass valve is required in the piping system. *(See 6.18.2.3.)*

5.17.3 Bypass Valves. Bypass valves shall have a maximum design pressure in accordance with Table 5.17.2.1.

5.17.3.1 If a bypass valve is installed in the system, it shall have a flow capacity equal to or greater than the pump in the system at the specified differential pressure.

5.17.4 Compressors.

5.17.4.1 Compressors shall be designed for LP-Gas service.

Table 5.17.1.3 Materials for Equipment Used in LP-Gas Service

Equipment Material	Service Condition
Steel Ductile (nodular) iron (ASTM A 395, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures,* or ASTM A 536, *Standard Specification for Ductile Iron Castings,* Grade 60–40–18 or 65–45–12) Malleable iron (ASTM A 47, *Standard Specification for Ferritic Malleable Iron Castings*) Higher strength gray iron (ASTM A 48, *Standard Specification for Gray Iron Castings,* Class 40B) Brass Materials equivalent to 5.17.1.3(A)(1) through 5.17.1.3(A)(5) in melting point, corrosion resistance, toughness, and strength	Pressure-containing metal parts
Cast iron	Not to be used as a material of construction for strainers or flow indicators
Aluminum	For approved meters, approved regulators, and indirect vaporizers
Zinc (ASTM B 86, *Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings*)	For approved regulators
Nonmetallic materials	Not to be used for upper or lower casings of regulators

Table 5.17.2.1 Maximum Allowable Working Pressure for Pumps and Bypass Valves

Maximum Differential Pressure Produced (psi)	Equipment Design Pressure Rating (psig)
≤125	350
>125 and ≤150	375
>150 and ≤200	400
>200	200 + maximum differential pressure

For SI units, 1 psi = 6.895 kPa.

5.17.4.2 Compressors shall be constructed or shall be equipped with auxiliary devices to limit the suction pressure to the maximum for which the compressor is designed.

5.17.4.3 Compressors shall be constructed or shall be equipped with auxiliary devices to prevent the entrance of LP-Gas liquid into the compressor suction.

5.17.4.4 Portable compressors used with temporary connections shall not require means to prevent liquid entrance into the compressor suction.

5.17.5 Reserved.

5.17.6 Meters.

5.17.6.1 Vapor meters of the tin or brass case type of soldered construction shall not be used at pressures in excess of 1 psig (7 kPag).

5.17.6.2 Vapor meters of the die cast or iron case type shall not be used at any pressure higher than the working pressure for which they are designed and marked.

5.17.6.3 Liquid meters shall be installed so that the meter housing is not subject to excessive strains from the connecting piping. Where used to provide flexibility in the fixed piping system, flexible connectors shall not exceed 36 in. (1 m) in total length.

5.17.7 Engines. Engines used to drive portable pumps and compressors shall be equipped with exhaust system spark arresters and shielded ignition systems.

5.17.8 Sight Flow Indicators. Where installed, sight flow indicators shall either be the simple observation type or be combined with a backflow check valve.

5.18 Reserved.

5.19 Reserved.

5.20 Appliances.

5.20.1 New residential, commercial, and industrial LP-Gas consuming appliances shall be approved.

5.20.2 Any appliance originally manufactured for operation with a gaseous fuel other than LP-Gas shall not be used with LP-Gas unless it is converted to use LP-Gas and is tested for performance with LP-Gas before being placed into use.

5.20.3 Unattended heaters used inside buildings for animal or poultry production or care shall be equipped with approved automatic devices to shut off the flow of gas to the main burners and to pilots, if used, in the event of flame extinguishment or combustion failure.

5.20.4 Approved automatic devices to shut off the flow of gas to the main burners and pilots shall not be required in structures without enclosing walls with the approval of the authority having jurisdiction.

5.20.5 Appliances using vaporizing burners shall comply with 5.21.5.

5.20.6* Appliances used in mobile homes and recreational vehicles shall be approved for such service.

5.20.7* LP-Gas appliances used on commercial vehicles shall be approved for the service.

(A) Gas-fired heating appliances and water heaters shall be equipped with automatic devices designed to shut off the flow of gas to the main burner and the pilot in the event the pilot flame is extinguished.

(B) Catalytic heating appliances shall be equipped with an approved automatic device to shut off the flow of gas in the event of combustion failure.

(C) Gas-fired heating appliances and water heaters to be used in vehicles intended for human occupancy shall be designed for complete separation of the combustion system and the living space.

(D) If the separation between the combustion system and the living space is not integral with the appliance, it shall be provided in accordance with installation requirements in 6.24.7.5.

5.21 Vaporizers, Tank Heaters, Vaporizing Burners, and Gas–Air Mixers.

5.21.1 Reserved.

5.21.2 Indirect Vaporizers.

5.21.2.1 Indirect vaporizers shall be constructed in accordance with the applicable provision of the ASME Code for a MAWP of 250 psig (1.7 MPag) and shall be permanently and legibly marked with the following:

(1) Marking required by the ASME Code
(2) Maximum allowable working pressure and temperature for which designed
(3) Name of the manufacturer

5.21.2.2 Indirect vaporizers that have an inside diameter of 6 in. (152 mm) or less are exempt from the ASME Code and shall not be required to be marked. They shall be constructed for a MAWP of 250 psig (1.7 MPag).

5.21.2.3 Indirect vaporizers shall be provided with an automatic means to prevent the passage of liquid through the vaporizer to the vapor discharge piping.

5.21.2.4 Indirect vaporizers, including atmospheric-type vaporizers using heat from the surrounding air or the ground and of more than 1 qt (0.9 L) capacity, shall be equipped with a spring-loaded pressure relief valve providing a relieving capacity in accordance with 5.21.9. Fusible plug devices shall not be used.

5.21.2.5 Indirect atmospheric-type vaporizers of less than 1 qt (0.9 L) capacity shall not be required to be equipped with pressure relief valves but shall be installed in accordance with 6.22.2.11.

5.21.3 Direct-Fired Vaporizers.

5.21.3.1 Design and construction of direct-fired vaporizers shall be in accordance with the applicable requirements of the ASME Code for the working conditions to which the vaporizer will be subjected, and the vaporizer shall be permanently and legibly marked with the following:

(1) Markings required by the ASME Code
(2) Maximum vaporizing capacity in gallons per hour
(3) Rated heat input in British thermal units per hour
(4) Name or symbol of the manufacturer

5.21.3.2 Direct-fired vaporizers shall be equipped with a spring-loaded pressure relief valve that provides a relieving capacity in accordance with 5.21.9.

5.21.3.3 The relief valve shall be located so as not to be subject to temperatures in excess of 140°F (60°C). Fusible plug devices shall not be used.

5.21.3.4 Direct-fired vaporizers shall be provided with automatic means to prevent the passage of liquid from the vaporizer to its vapor discharge piping.

5.21.3.5 A means for manually turning off the gas to the main burner and pilot shall be provided.

5.21.3.6 Direct-fired vaporizers shall be equipped with an automatic safety device to shut off the flow of gas to the main burner if the pilot light is extinguished.

5.21.3.7 If the pilot flow exceeds 2000 Btu/hr (2 MJ/hr), the safety device shall also shut off the flow of gas to the pilot.

5.21.3.8 Direct-fired vaporizers shall be equipped with a limit control to prevent the heater from raising the product pressure above the design pressure of the vaporizer equipment, and to prevent raising the pressure within the storage container above the pressure specified in the first column of Table 5.2.4.2 that corresponds with the design pressure of the container (or its ASME Code equivalent). *(See notes to Table 5.2.4.2.)*

5.21.4 Tank Heaters.

5.21.4.1 Tank heaters shall be approved for the application and shall be used according to the manufacturer's instructions.

5.21.4.2 Tank heaters shall be approved and shall be permanently and legibly marked with the following:

(1) Rated input to the burner in British thermal units per hour
(2) Maximum vaporizing capacity in gallons per hour
(3) Name or symbol of the manufacturer

5.21.4.3 Manufacturer's instructions for tank heaters shall provide direction for their use for heating LP-Gas containers.

5.21.4.4 Tank heaters shall be equipped with a limit control to prevent the heater from raising the pressure in the storage container to more than 75 percent of the pressure shown in the first column of Table 5.2.4.2 that corresponds with the MAWP of the container (or its ASME *Boiler and Pressure Vessel Code* equivalent).

5.21.4.5 Tank heaters of the electric immersion type shall be automatically de-energized when the liquid level falls below the top of the heater.

5.21.4.6 Devices that cannot apply a temperature in excess of 90°F (32°C) shall not be required to comply with 5.21.4.4 and 5.21.4.5.

5.21.4.7 Direct-type tank heaters shall be designed such that the heater can be removed for inspection of the entire container.

5.21.4.8 Direct gas-fired tank heaters shall be designed exclusively for outdoor aboveground use.

5.21.4.9 Direct gas-fired tank heaters shall be designed such that there is no direct flame impingement upon the container.

5.21.4.10 Fuel gas supply connections to direct gas-fired tank heaters originating in the vapor space of the container shall be provided with a manually operated shutoff valve at the heater.

5.21.4.11 Heater control systems shall be equipped with an automatic safety shutoff valve of the manual reset type arranged to shut off the flow of gas to both the main and pilot burners if the pilot flame is extinguished.

5.21.4.12 Where installed on containers exceeding 1000 gal (3.8 m^3) water capacity, the heater control system shall include a valve to automatically shut off the flow of gas to both the main and pilot burners if the container becomes empty of liquid.

5.21.5 Vaporizing Burners.

5.21.5.1 Section 5.21 shall not apply to engine fuel vaporizers or to integral vaporizer burners, such as those used with weed burning equipment and tar kettles.

5.21.5.2 Vaporizing burners shall be constructed with a pressure rating of 250 psig (1.7 MPag), with a safety factor of 5 to 1.

5.21.5.3 The vaporizing burner or the appliance in which it is installed shall be permanently and legibly marked with the following:

(1) Maximum burner input in British thermal units per hour
(2) Name or symbol of the manufacturer

5.21.5.4 Vaporizing coils or jackets shall be made of ferrous metals or high-temperature alloys.

5.21.5.5 The vaporizing section shall be protected by a relief valve, located where it will not be subject to temperatures in excess of 140°F (60°C), and with a pressure setting sufficient to protect the components involved but not lower than 250 psig (1.7 MPag).

5.21.5.6 The relief valve discharge shall be directed upward and away from the component parts of the vaporizing burner. Fusible plug devices shall not be used.

5.21.5.7 A valve shall be provided to turn off the gas supply to the main burner and the pilot.

5.21.5.8 Vaporizing burners shall be provided with an automatic safety device to shut off the flow of gas to the main burner and pilot in the event the pilot is extinguished.

5.21.5.9* Dehydrators and dryers utilizing vaporizing burners shall be equipped with automatic devices both upstream and downstream of the vaporizing section. These devices shall be installed and connected to shut off in the event of excessive temperature, flame failure, and, if applicable, insufficient airflow.

5.21.5.10 Pressure-regulating and control equipment shall be so located or so protected to prevent its exposure to temperatures above 140°F (60°C), unless designed and recommended for use at a higher temperature by the manufacturer.

5.21.5.11 Pressure-regulating and control equipment located downstream of the vaporizing section shall be designed to withstand the maximum discharge temperature of hot vapor.

5.21.6 Waterbath Vaporizers.

5.21.6.1 The vaporizing chamber, tubing, pipe coils, or other heat exchange surface containing the LP-Gas to be vaporized, hereinafter referred to as heat exchanger, shall be constructed in accordance with the applicable provisions of the ASME Code for a MAWP of 250 psig (1.7 MPag) and shall be permanently and legibly marked with the following:

(1) Marking required by the ASME Code
(2) MAWP and temperature for which the heat exchanger is designed
(3) Name or symbol of the manufacturer

5.21.6.2 Heat exchangers for waterbath vaporizers that have an inside diameter of 6 in. (150 mm) or less are exempt from the ASME Code and shall not be required to be marked.

5.21.6.3 Heat exchangers for waterbath vaporizers shall be provided with automatic control to prevent the passage of liquid through the heat exchanger to the vapor discharge piping. This control shall be integral with the vaporizer.

5.21.6.4 Heat exchangers for waterbath vaporizers shall be equipped with a spring-loaded pressure relief valve that provides a relieving capacity in accordance with 5.21.9. Fusible plug devices shall not be used.

5.21.6.5 Waterbath sections of waterbath vaporizers shall be designed to prevent pressure from exceeding the design pressure.

5.21.6.6 The immersion heater that provides heat to the waterbath shall be installed so as not to contact the heat exchanger.

5.21.6.7 A control to limit the temperature of the waterbath shall be provided.

5.21.6.8 Gas-fired immersion heaters shall be equipped with an automatic safety device to shut off the flow of gas to the main burner and pilot in the event of flame failure.

5.21.6.9 Gas-fired immersion heaters with an input of 400,000 Btu/hr (422 MJ/hr) or more shall be equipped with an electronic flame safeguard and with programming to provide for prepurge prior to ignition, proof of pilot before the main burner valve opens, and full shutdown of the main gas valve and pilot upon flame failure.

5.21.6.10 The heat source shall be shut off if the level of the heat transfer medium falls below the top of the heat exchanger.

5.21.7 Reserved.

5.21.8 Gas–Air Mixers.

5.21.8.1 Gas–air mixers shall be designed for the air, vapor, and mixture pressures to which they are subjected.

5.21.8.2 Gas–air mixers that are capable of producing combustible mixtures shall be equipped with safety interlocks on both the LP-Gas and air supply lines to shut down the system if combustible limits are approached.

5.21.8.3 In addition to the interlocks required in 5.21.8.2, a method shall be provided to prevent air from accidentally entering gas distribution lines without LP-Gas being present. Gas-mixing control valves installed in the air and LP-Gas supply lines that fail closed when actuated by safety trip devices shall meet this requirement.

5.21.8.4 Check valves shall be installed in the air and LP-Gas supply lines close to the mixer to minimize the possibility of backflow of gas into the air supply lines or of air into the LP-Gas system. Gas-mixing control valves installed in the air and LP-Gas supply lines that fail closed when actuated by safety trip devices shall meet this requirement.

5.21.8.5 Gas–air mixers that utilize the kinetic energy of the LP-Gas vapor to entrain air from the atmosphere, and are so designed that maximum air entrained is less than 85 percent of the mixture, shall comply with the following:

(1) They shall be exempt from the interlock provisions in 5.21.8.2 through 5.21.8.4.
(2) They shall be equipped with a check valve at the air intake to prevent the escape of gas to atmosphere when shut down.

5.21.8.6 Gas–air mixers of the type specified in 5.21.8.5 receiving air from a blower, compressor, or any source of air other than directly from the atmosphere shall prevent air without LP-Gas, or mixtures of air and LP-Gas within the flammable range, from entering the gas distribution system accidentally.

5.21.9 Vaporizer Pressure Relief Valve.

5.21.9.1 The minimum rate of discharge in cubic feet of air per minute for pressure relief valves for LP-Gas vaporizers, either of the indirect type or direct-fired type, shall comply with 5.21.9.2 through 5.21.9.4.

5.21.9.2 Based on conservative heat transfer calculations (assuming that the vaporizing chamber is liquid full), the maximum vapor generating capacity (rate) shall be determined when maximum heat is available. That vapor rate shall be converted to an equivalent air rate.

5.21.9.3 If the vaporizer is direct fired or if a substantial exterior surface is in contact with the LP-Gas, the sum of the vaporizer surface and the LP-Gas wetted exterior surface shall be used in conjunction with Table 5.7.2.6 to determine the required relief valve capacity.

5.21.9.4 The minimum rate of discharge in cubic feet of air per minute for pressure relief valves for LP-Gas vaporizers, of either the indirect type or direct-fired type, shall be at least 150 percent of the rated vaporizing capacity.

5.22 Vehicle Fuel Dispensers.

5.22.1 The dispenser shall have a maximum design pressure rating equal to or greater than the maximum discharge pressure from the pump and bypass valve, if provided.

5.22.2 The maximum design pressure and all equipment downstream from the pump shall be in accordance with Table 5.17.2.1.

Chapter 6 Installation of LP-Gas Systems

6.1 Scope.

6.1.1* Application. This chapter applies to the following:

(1) Location and field installation of LP-Gas systems that use components, subassemblies, container assemblies, and container systems that are fabricated in accordance with Chapter 5
(2) Location of containers and liquid transfer systems
(3) Installation of container appurtenances and regulators
(4) Installation of piping (including flexible connectors and hose), hydrostatic relief valves, and piping service limitations
(5) Installation of equipment
(6) Testing of piping systems

6.1.2 Nonapplication. This chapter does not apply to the following:

(1) Refrigerated containers
(2) Installation of systems used in the highway transportation of LP-Gas

6.1.3* Additional Features. For any purpose or application addressed within the scope of this chapter, if the requirements of the chapter are met, any or all additional features or components of equipment not prohibited by the chapter shall be permitted to be used.

6.2 Location of Containers.

6.2.1 LP-Gas containers shall be located outside of buildings unless they are specifically allowed to be located inside of buildings.

6.2.2 LP-Gas containers shall be allowed in buildings only for the following applications:

(1) Cylinders as specifically provided for in Section 6.20
(2) Containers of less than 125 gal (0.5 m^3) water capacity for the purposes of being filled in buildings or structures complying with Chapter 10
(3) Containers on LP-Gas vehicles complying with, and parked or garaged in accordance with, Chapter 9
(4) Containers used with LP-Gas portable engine fuel systems complying with 11.15.1
(5) Containers used with LP-Gas stationary engine fuel systems complying with 6.26
(6) Containers used with LP-Gas–fueled industrial trucks complying with 11.13.4
(7) Containers on LP-Gas–fueled vehicles garaged in accordance with Section 11.16
(8) Cylinders awaiting use, resale, or exchange when stored in accordance with Chapter 8

6.3 Container Separation Distances.

6.3.1 Aboveground Containers.

6.3.1.1* Containers installed outside of buildings, whether of the portable type replaced on a cylinder exchange basis or permanently installed and refilled at the installation, shall be located with respect to the adjacent containers, important building, group of buildings, or line of adjoining property that can be built upon, in accordance with Table 6.3.1.1, Table 6.4.1.2, 6.3.1.2 through 6.3.1.3, 6.3.3, 6.3.4.1 through 6.3.4.4, and 6.4.4.6 through 6.4.4.11.

6.3.1.2 When the provisions of 6.28.3 through 6.28.5 are met, the minimum distance from an ASME container to a building shall be reduced by one-half for ASME containers of 2001 gal through 30,000 gal (7.6 m^3 through 114 m^3) water capacity.

6.3.1.3 The 25 ft (7.6 m) minimum distance from aboveground ASME containers of 501 gal through 2000 gal (1.9 m^3 through 7.6 m^3) water capacity to buildings, a group of buildings, or the line of adjoining property that can be built upon shall be reduced to 10 ft (3 m) for a single ASME container of 1200 gal (4.5 m^3) or less water capacity where such container is at least 25 ft (7.6 m) from any other LP-Gas container of more than 125 gal (0.5 m^3) water capacity.

6.3.2 Underground or Mounded ASME Containers.

6.3.2.1 Minimum distances for underground or mounded ASME containers of 2001 gal through 30,000 gal (7.6 m^3 through 114 m^3) water capacity, incorporating all the provisions of Section 6.28, shall be reduced to 10 ft (3 m).

6.3.2.2 Distances for all underground and mounded ASME containers shall be measured from the container surface.

6.3.2.3 No part of an underground or mounded ASME container shall be less than 10 ft (3 m) from a building or line of adjoining property that can be built upon.

6.3.3 Minimum Separation Distances for ASME Containers.

6.3.3.1 The minimum separation distances specified in Table 6.3.1.1 between containers and buildings of other than woodframe construction devoted exclusively to gas manufacturing and distribution operations shall be reduced to 10 ft (3 m).

6.3.3.2 If the aggregate water capacity of a multicontainer installation is 501 gal (1.9 m^3) or more and the installation is comprised of individual containers, each with a water capacity of less than 125 gal (0.5 m^3), the minimum distance shall comply with Table 6.3.1.1 and 6.3.3.2(A) through 6.3.3.2(C).

(A) The aggregate capacity shall be used rather than the capacity per container.

Table 6.3.1.1 Separation Distances Between Containers, Important Buildings, and Line of Adjoining Property That Can Be Built Upon

Water Capacity per Container		Minimum Distances					
		Mounded or Underground Containers[a]		Aboveground Containers		Between Containers[b]	
gal	m^3	ft	m	ft	m	ft	m
<125[c]	<0.5[c]	10	3	0[d]	0[d]	0	0
125–250	0.5–1.0	10	3	10	3	0	0
251–500	>1.0–1.9	10	3	10	3	3	1
501–2,000	>1.9–7.6	10	3	25[e]	7.6	3	1
2,001–30,000	>7.6–114	50	15	50	15	5	1.5
30,001–70,000	>114–265	50	15	75	23		
70,001–90,000	>265–341	50	15	100	30	¼ of sum of	
90,001–120,000	>341–454	50	15	125	38	diameters of	
120,001–200,000	>454–757	50	15	200	61	adjacent	
200,001–1,000,000	>757–3,785	50	15	300	91	containers	
>1,000,000	>3,785	50	15	400	122		

[a]See 6.3.2.1.
[b]See 6.3.4.5.
[c]See 6.3.4.4.
[d]See 6.3.4.1, 6.3.4.2, 6.3.4.3, and 6.3.4.4.
[e]See 6.3.1.3.

(B) If more than one such installation is made, each installation shall be separated from any other installation by at least 25 ft (7.6 m).

(C) The minimum distances between containers shall not be applied to installations covered by 6.3.3.2.

6.3.4 Separation Distance Between Container Pressure Relief Valve and Building Openings.

6.3.4.1 Cylinders shall not be located and installed underneath any building unless the space is open to the atmosphere for 50 percent of its perimeter or more.

6.3.4.2 ASME containers of less than 125 gal (0.5 m^3) water capacity shall be located and installed so that the discharge from pressure relief devices shall not terminate in or beneath any building.

6.3.4.3* The distance measured horizontally from the point of discharge of a container pressure relief valve to any building opening below the level of such discharge shall be in accordance with Table 6.3.4.3.

6.3.4.4 The distance measured in any direction from the point of discharge of a container pressure relief valve, vent of a fixed maximum liquid level gauge on a container, and the container filling connection to exterior sources of ignition, openings into direct-vent (sealed combustion system) appliances, and mechanical ventilation air intakes shall be in accordance with Table 6.3.4.3.

6.3.4.5 Access at the ends or sides of individual underground containers having a water capacity of 125 gal (0.5 m^3) or more shall be provided in multicontainer installations to facilitate working with cranes or hoists.

Table 6.3.4.3 Separation Distance Between Container Pressure Relief Valve and Building Openings

Container Type	Exchange or Filled on Site at Point of Use	Distance Horizontally from Relief Valve Discharge to Opening Below Discharge		Discharge from Relief Valve, Vent Discharge, and Filling Connection to Exterior Source of Ignition, Openings into Direct-Vent Appliances, and Mechanical Ventilation Air Intakes	
		ft	m	ft	m
Cylinder	Exchange	3	0.9	5	1.5
Cylinder	Filled on site at the point of use	3	0.9	10	3.0
ASME	Filled on site at the point of use	5	1.5	10	3.0

6.4 Other Container Location Requirements.

6.4.1 ASME Multicontainer Requirements.

6.4.1.1 Where storage containers having an aggregate water capacity of more than 4000 gal (15.2 m^3) are located in heavily populated or congested areas, the siting provisions of 6.3.1.1 and Table 6.3.1.1 shall be permitted to be modified as indicated by the fire safety analysis described in 6.27.3.

6.4.1.2 Aboveground multicontainer installations comprised of ASME containers having an individual water capacity of 12,000 gal (45 m^3) or more and installed for use in a single location shall be limited to the number of containers in one group, with each group separated from the next group in accordance with the degree of fire protection provided in Table 6.4.1.2.

Table 6.4.1.2 Maximum Number of Containers in a Group and Their Separation Distances

Fire Protection Provided by	Maximum Number of Containers in One Group	Minimum Separation Between Groups	
		ft	m
Hose streams only *(see 6.4.1.2 and 6.27.3.1)*	6	50	15
Fixed monitor nozzles per 6.27.6.3	6	25	7.6
Fixed water spray per 6.27.6.1	9	25	7.6
Insulation per 6.27.5.1	9	25	7.6

6.4.1.3 Where the provisions of 6.28.3 and 6.28.4 are met, the minimum separation distance between groups of ASME containers protected by hose stream only shall be one-half the distances required in Table 6.4.1.2.

6.4.2 Underground and Mounded ASME Containers.

6.4.2.1 Underground or mounded ASME containers shall be located in accordance with 6.4.2.2 and 6.4.2.3.

6.4.2.2 Underground or mounded containers shall be located outside of any buildings.

6.4.2.3 Buildings shall not be constructed over any underground or mounded containers.

6.4.3 General Requirements.

6.4.3.1 The sides of adjacent containers shall be separated in accordance with Table 6.3.1.1 but shall not be separated by less than 3 ft (1 m).

6.4.3.2 Where containers are installed parallel with ends in line, the number of containers in one group shall not be limited.

6.4.3.3 Where more than one row of containers is installed, the adjacent ends of the containers in each row shall be separated by not less than 10 ft (3 m).

6.4.4 Additional Container Installation Requirements.

6.4.4.1 Additional container installation requirements shall comply with 6.4.4.2 through 6.4.4.14 and 6.4.5.

6.4.4.2 Containers shall not be stacked one above the other.

6.4.4.3* Combustible materials shall not accumulate or be stored within 10 ft (3 m) of a container.

6.4.4.4* The area under containers shall be graded or shall have dikes or curbs installed so that the flow or accumulation of flammable liquids with flash points below 200°F (93.4°C) is prevented.

6.4.4.5 LP-Gas containers shall be located at least 10 ft (3 m) from the centerline of the wall of diked areas containing flammable or combustible liquids.

6.4.4.6 The minimum horizontal separation between aboveground LP-Gas containers and aboveground tanks containing liquids having flash points below 200°F (93.4°C) shall be 20 ft (6 m).

6.4.4.7 The requirements of 6.4.4.6 shall not apply where LP-Gas containers of 125 gal (0.5 m^3) or less water capacity are installed adjacent to fuel oil supply tanks of 660 gal (2.5 m^3) or less capacity.

6.4.4.8 No horizontal separation shall be required between aboveground LP-Gas containers and underground tanks containing flammable or combustible liquids installed in accordance with NFPA 30, *Flammable and Combustible Liquids Code.*

6.4.4.9* The minimum separation between LP-Gas containers and oxygen or gaseous hydrogen containers shall be in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code.*

6.4.4.10 Where protective structures having a minimum fire resistance rating of 2 hours interrupt the line of sight between uninsulated portions of the oxygen or hydrogen containers and the LP-Gas containers, no minimum distance shall apply.

6.4.4.11 The minimum separation between LP-Gas containers and liquefied hydrogen containers shall be in accordance with NFPA 55, *Compressed Gases and Cryogenic Fluids Code.*

6.4.4.12 Where LP-Gas cylinders are to be stored or used in the same area with other compressed gases, the cylinders shall be marked to identify their content in accordance with ANSI/CGA C-7, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers.*

6.4.4.13 An aboveground LP-Gas container and any of its parts shall not be located within 6 ft (1.8 m) of a vertical plane beneath overhead electric power lines that are over 600 volts, nominal.

6.4.4.14* Refrigerated LP-Gas containers shall be located within an impoundment in accordance with Section 12.5.

6.4.5* Structure Requirements.

6.4.5.1 Structures such as fire walls, fences, earth or concrete barriers, and other similar structures shall not be permitted around or over installed nonrefrigerated containers unless specifically allowed.

6.4.5.2 Structures partially enclosing containers shall be permitted if designed in accordance with a sound fire protection analysis.

6.4.5.3 Structures used to prevent flammable or combustible liquid accumulation or flow shall be permitted in accordance with 6.4.4.4.

6.4.5.4 Structures between LP-Gas containers and gaseous hydrogen containers shall be permitted in accordance with 6.4.4.10.

6.4.5.5 Structures such as fences shall be permitted in accordance with 6.19.4.

6.5 Location of Transfer Operations.

6.5.1 Transfer of Liquids.

6.5.1.1* Liquid shall be transferred into containers, including containers mounted on vehicles, only outdoors or in structures specially designed for such purpose.

6.5.1.2 The transfer of liquid into containers mounted on vehicles shall not take place within a building but shall be permitted to take place under a weather shelter or canopy. *(See 6.25.3.3.)*

6.5.1.3 Structures housing transfer operations or converted for such use after December 31, 1972, shall comply with Chapter 10.

6.5.1.4 The transfer of liquid into containers on the roofs of structures shall be permitted, provided that the installation conforms to the requirements specified in 6.6.7 and 6.20.11.

6.5.1.5 The transfer hose shall not be routed in or through any buildings except those specified in 6.5.1.3.

6.5.1.6 Filling of containers located outdoors in stationary installations in accordance with Section 6.3 shall be permitted to be filled at that location.

6.5.2 Container Point of Transfer Location Requirements.

6.5.2.1 If the point of transfer of containers located outdoors in stationary installations is not located at the container, it shall be located in accordance with Table 6.5.2.1.

6.5.2.2 Containers not located in stationary installations shall be filled at a location determined by the point of transfer in accordance with Table 6.5.2.1.

6.5.3 Separation Distance from Point of Transfer.

6.5.3.1 If the point of transfer is a component of a system covered by Section 6.24 or Chapter 11, the requirements of parts A, B, and C of Table 6.5.2.1 shall not apply to the structure containing the point of transfer.

6.5.3.2 If LP-Gas is vented to the atmosphere under the conditions stipulated in 7.3.1(5), the distances in Table 6.5.2.1 shall be doubled.

6.5.3.3 If the point of transfer is housed in a structure complying with Chapter 10, and the common walls comply with 10.2.1, separation distances in Table 6.5.2.1 shall not be required where the common walls comply with 10.3.1.3.

6.5.3.4 The distances in Table 6.5.2.1, parts B, C, D, E, F(2), and J, shall be reduced by one-half where the system incorporates the provisions of low emission transfer as provided in 6.28.5.

Table 6.5.2.1 Distance Between Point of Transfer and Exposures

Part	Exposure	Minimum Horizontal Distance ft	Minimum Horizontal Distance m
A	Buildings,[a] mobile homes, recreational vehicles, and modular homes with at least 1-hour fire-rated walls[b]	10[c]	3.1
B	Buildings[a] with other than at least 1-hour fire-rated walls[b]	25[c]	7.6[c]
C	Building wall openings or pits at or below the level of the point of transfer	25[c]	7.6[c]
D	Line of adjoining property that can be built upon	25[c]	7.6[c]
E	Outdoor places of public assembly, including schoolyards, athletic fields, and playgrounds	50[c]	15[c]
F	Public ways, including public streets, highways, thoroughfares, and sidewalks		
	(1) From points of transfer in LP-Gas dispensing stations and at vehicle fuel dispensers	10	3.1
	(2) From other points of transfer	25[c]	7.6[c]
G	Driveways[d]	5	1.5
H	Mainline railroad track centerlines	25	7.6
I	Containers[e] other than those being filled	10	3.1
J	Flammable and Class II combustible liquid[f] dispensers and the fill connections of containers	10[c]	3.1[c]
K	Flammable and Class II combustible liquid aboveground containers and filling connections of underground containers	20	6.1

[a]For the purpose of the table, buildings also include structures such as tents and box trailers at construction sites.

[b]See ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests for Building Construction and Materials*.

[c]See 6.5.3.4.

[d]Not applicable to driveways and points of transfer at vehicle fuel dispensers.

[e]Not applicable to filling connections at the storage container or to dispensing vehicle fuel dispenser units of 4000 gal (15.2 m^3) water capacity or less when used for filling containers not mounted on vehicles.

[f]NFPA 30, *Flammable and Combustible Liquids Code*, defines these as follows: Flammable liquids include those having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psia (276 kPa) at 100°F (37.8°C). Class II combustible liquids include those having a flash point at or above 100°F (37.8°C) and below 140°F (60°C).

6.6 Installation of Containers.

6.6.1 General Requirements.

6.6.1.1 Containers shall be positioned so that the pressure relief valve is in direct communication with the vapor space of the container.

6.6.1.2 LP-Gas containers or systems of which they are a part that are installed within 10 ft (3 m) of public vehicular thoroughfares shall be provided with a means of vehicular barrier protection.

6.6.1.3 Field welding on containers shall be limited to nonpressure parts such as saddle plates, wear plates, or brackets installed by the container manufacturer.

6.6.1.4* Aboveground containers shall be painted.

6.6.1.5 Containers shall be installed so that all container operating appurtenances are accessible.

6.6.1.6 Where necessary to prevent flotation due to possible high flood waters around aboveground or mounded containers, or high water table for those underground and partially underground, containers shall be securely anchored.

6.6.2 Installation of Cylinders.

6.6.2.1 Cylinders shall be installed only aboveground and shall be set upon a firm foundation or otherwise be firmly secured. *(See 6.6.2.2.)*

6.6.2.2 The cylinder shall not be in contact with the soil.

6.6.2.3 Flexibility shall be provided in the connecting piping. *(See 6.6.2.4.)*

6.6.2.4 Where flexible connectors are used, they shall comply with 6.9.6.

6.6.3 Installation of Horizontal Aboveground ASME Containers.

6.6.3.1 Horizontal ASME containers designed for permanent installation in stationary aboveground service shall be placed on masonry or other noncombustible structural supports located on concrete or masonry foundations with the container supports.

(A) Where saddles are used to support the container, they shall allow for expansion and contraction and prevent an excessive concentration of stresses.

(B) Where structural steel supports are used, they shall comply with 6.6.3.3.

(C) Containers of more than 2000 gal (7.6 m^3) water capacity shall be provided with concrete or masonry foundations formed to fit the container contour or, if furnished with saddles in compliance with Table 6.6.3.3(A), shall be placed on flat-topped foundations.

(D) Containers of 2000 gal (7.6 m^3) water capacity or less shall be installed either on concrete or masonry foundations formed to fit the container contour or in accordance with 6.6.3.1(E).

(E) Containers of 2000 gal (7.6 m^3) water capacity or less and equipped with attached supports complying with Table 6.6.3.3(A) shall be installed on a fire-resistive foundation if the bottoms of the horizontal members of the container saddles, runners, or skids are more than 12 in. (300 mm) above grade.

(F) Containers of 2000 gal (7.6 m^3) water capacity or less shall not be mounted with the outside bottom of the container shell more than 5 ft (1.5 m) above the surface of the ground.

(G) Containers of 4000 gal (15.2 m^3) water capacity or less installed with combined container-pump assemblies on a common base complying with Table 6.6.3.3(A) shall be placed either on paved surfaces or on concrete pads at ground level within 4 in. (100 mm) of ground level.

6.6.3.2 ASME containers that have liquid interconnections shall be installed so that the maximum permitted filling level of each container is at the same elevation.

6.6.3.3 Support of horizontal ASME containers shall comply with 6.6.3.3(A) through 6.6.3.3(D).

(A) Horizontal ASME containers with attached supports and designed for permanent installation in stationary service shall be installed in accordance with Table 6.6.3.3(A).

Table 6.6.3.3(A) Installation of Permanently Installed Horizontal ASME Containers with Attached Supports

Container Size			
gal	m^3	Attached Support	Height of Container Bottom
≥4000	≥15.2	Non-fireproofed steel on flat-topped concrete foundations	6 in. (150 mm) maximum above concrete foundations
≤4000	≤15.2	Non-fireproofed steel on masonry or concrete foundations more than 12 in. (300 mm) above the ground	2 in. to 12 in. (51 mm to 300 mm) above concrete foundation
≤4000	≤15.2	Non-fireproofed steel on paved surfaces or concrete pads within 4 in. (100 mm) of the ground	24 in. (610 mm) maximum above paved surface or top of concrete pads
≤4000	≤15.2	Foundations or supports for horizontal LP-Gas containers per 6.6.3.3(B)	24 in. (610 mm) maximum above paved surface

(B) Steel supports shall be protected against fire exposure with a material having a fire resistance rating of at least 2 hours if the height limits specified in Table 6.6.3.3(A) are exceeded.

(C) The test to determine the fire resistance rating shall be ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials.*

(D) Horizontal ASME containers of 2000 gal (7.6 m^3) or less, on foundations in their installed condition, shall meet the following conditions:

(1) Structurally support the containers when subject to deteriorating environmental effects including, but not limited to, ambient temperature of –40°F to 150°F (–40°C to 66°C) or local conditions if outside this range, ultraviolet rays, radiant heat from fires, and moisture
(2) Be of either noncombustible or self-extinguishing material (per the definition in NFPA 99, *Health Care Facilities Code*, 3.3.163)

6.6.3.4 Where a single ASME container complying with Table 6.6.3.3(A) is installed in isolated locations with nonfireproofed steel supports resting on concrete pads or footings and the outside bottom of the container shell is not more than 5 ft (1.5 m) above the ground level, the approval of the authority having jurisdiction shall be obtained.

6.6.3.5 The part of an ASME container in contact with saddles, foundations, or masonry shall be coated or protected to minimize corrosion.

6.6.3.6 In locations where the monthly maximum depth of snow accumulation, as determined from the National Weather Service or other published statistics, is more than the height of aboveground containers, excluding the dome cover, the following requirements shall apply:

(1) A stake or other marking shall be installed higher than the average snow cover depths, up to a height of 15 ft (4.6 m).
(2) The container shall be installed to prevent its movement resulting from snow accumulation.

6.6.3.7 If the container is mounted on or is part of a vehicle in accordance with 5.2.7.2(B), the unit shall be located in accordance with 6.3.1.1.

(A) The surface on which the vehicle is parked shall be level and, if not paved, shall be able to support heavy vehicular traffic and shall be clear of dry grass, weeds, and other combustible material within 10 ft (3 m) of the container.

(B) Flexibility shall be provided in the connecting piping in accordance with 6.9.6.

6.6.3.8 Portable tanks of 2000 gal (7.6 m^3) water capacity or less that comply with 5.2.7.3 shall be installed in accordance with 6.6.3.1(E).

6.6.4 Installation of Vertical ASME Containers.

6.6.4.1 Vertical ASME containers of over 125 gal (0.5 m^3) water capacity designed for permanent installation in stationary aboveground service shall be installed on reinforced concrete or steel structural supports on reinforced concrete foundations that are designed to meet the loading provisions established in 5.2.4.3.

6.6.4.2 The requirements in 6.6.4.3 through 6.6.4.5 shall also apply to the installation of vertical ASME containers.

6.6.4.3 Steel supports shall be protected against fire exposure with a material that has a fire resistance rating of at least 2 hours, except that continuous steel skirts that have only one opening that is 18 in. (460 mm) or less in diameter shall have fire protection applied to the outside of the skirts.

6.6.4.4 Vertical ASME containers used in liquid service shall not be manifolded to horizontal ASME containers.

6.6.4.5 Vertical ASME containers of different dimensions shall not be manifolded together.

6.6.5 Temporary Container Installations.

6.6.5.1 Single containers constructed as portable storage containers for temporary stationary service in accordance with 5.2.7.2 shall be placed on concrete pads, paved surfaces, or firm earth for such temporary service (not more than 12 months at a given location).

6.6.5.2 The surface on which the containers are placed shall be level and, if not paved, shall be clear of dry grass, weeds, and other combustible material within 10 ft (3 m) of the container.

6.6.5.3 Flexibility shall be provided in the connecting piping in accordance with 6.9.6.

6.6.5.4 Where portable storage containers are installed at isolated locations with the bottoms of the skids or runners above the ground, either fire-resistive supports shall be provided or non–fire-resistive supports shall be permitted when all the following conditions are met:

(1) The height of the outside bottom of the container does not exceed 5 ft (1.5 m) above the ground.
(2) The approval of the authority having jurisdiction is obtained.

6.6.6 Installation of Underground and Mounded Containers.

6.6.6.1* ASME container assemblies intended for underground installation, including interchangeable aboveground–underground container assemblies, shall be installed underground in accordance with 6.6.6.1(A) through 6.6.6.1(M).

(A) Containers installed in areas with no vehicular traffic shall be installed at least 6 in. (150 mm) below grade.

(B) At installations within 10 ft (3 m) of a public vehicular thoroughfare or designated parking location, a noninterchangeable underground container shall be installed 18 in. (460 mm) below grade or vehicular barrier protection shall be provided.

(C) Installations within 10 ft (3 m) of a public vehicular thoroughfare or designated parking location shall be provided with vehicular barrier protection for the container's fitting housing, housing cover, container connections, and piping.

(D) Approved interchangeable aboveground–underground container assemblies installed underground shall not be placed with the container shell more than 12 in. (300 mm) below grade.

(E) The installation of a buried container shall include protection for the container and piping against physical damage from vehicular traffic.

(F) Prior to digging, the location of underground and mounded containers and piping in the vicinity of construction and excavation activities shall be determined and the installation shall be protected from damage.

(G) Where a container is to be abandoned underground, the following procedure shall be followed:

(1) As much liquid LP-Gas as practical shall be removed through the container liquid withdrawal connection.
(2)*As much of the remaining LP-Gas vapor as practical shall be removed through a vapor connection.
(3) The vapor shall be either recovered, burned, or vented to the atmosphere.
(4) Where only vapor LP-Gas at atmospheric pressure remains in the container, the container shall be filled with water, sand, or foamed plastic or shall be purged with an inert gas.
(5) If purged, the displaced vapor shall be either recovered, burned, or vented to the atmosphere.

(H)* The discharge of the regulator vent shall be above the highest probable water level.

(I)* A corrosion protection system shall be installed on new installations of underground steel containers, unless technical justification is provided to and is approved by the authority having jurisdiction. The corrosion protection system shall include the following:

(1) A container coating complying with 5.2.1.11
(2) A cathodic protection system that consists of a sacrificial anode(s) or an impressed current anode
(3) A means to test the performance of the cathodic protection system in accordance with 6.17.3

(J) Prior to burial, the container shall be visually examined for damage to the coating. Damaged areas shall be repaired with a coating recommended for underground service and compatible with the existing coating.

(K)* Containers shall be set level and shall be surrounded by earth or sand firmly tamped in place.

(L)* Where electrical isolation is provided between buried metallic piping and an underground container, the dielectric connection shall comply with the applicable requirements of Section 5.9 or shall be listed.

(M) Backfill shall be free of rocks and abrasives.

6.6.6.2 Partially underground, unmounded ASME containers shall be installed in accordance with 6.6.6.2(A) through 6.6.6.2(F).

(A) The portion of the container below the surface of the ground, and for a vertical distance of at least 3 in. (75 mm) above that surface, shall comply with the corrosion protection requirements of 6.6.6.1(I) through (J).

(B) The aboveground portion of the container shall be painted to comply with 6.6.1.4.

(C) Containers shall be set level and shall be surrounded by earth or sand firmly tamped in place.

(D) Backfill shall be free of rocks and abrasives.

(E) Spacing provisions shall be as specified for aboveground containers in 6.3.1.1 and Table 6.3.1.1.

(F) The container shall be located so as not to be subject to vehicular damage or shall be protected against such damage.

6.6.6.3 Mounded containers shall be installed in accordance with 6.6.6.3(A) through 6.6.6.3(F).

(A)* Mounding material shall be earth, sand, or other noncombustible, noncorrosive materials and shall provide a minimum thickness of cover for the container of at least 1 ft (0.3 m).

(B) A protective cover shall be provided on top of mounding materials subject to erosion.

(C) Container valves and appurtenances shall be accessible for operation or repair, without disturbing mounding material.

(D) Where containers are mounded and the bottom of the container is 30 in. (0.76 m) or more above the surrounding grade, access to bottom connections shall be provided by an opening or tunnel with a 4 ft (1.2 m) minimum diameter and a 3 ft (0.9 m) minimum clear area.

(E) Bottom connections that extend beyond the mound shall be part of the ASME container or shall be installed in compliance with the ASME Code and shall be designed for the forces that can act on the connections.

(F) Mounded containers shall comply with the corrosion protection requirements of 6.6.6.1(I) and 6.6.6.1(J).

6.6.7 Installation of Containers on Roofs of Buildings.

6.6.7.1 Installation of containers on roofs of buildings shall be prohibited, unless approved by the authority having jurisdiction and the fire department.

6.6.7.2 Where the authority having jurisdiction and the fire department have approved an installation of a container, it shall comply with 6.6.7.2(A) through 6.6.7.2(S).

(A) The building shall be of Type I, 443 or 332, or Type II, 222, construction as specified in NFPA 220, *Standard on Types of Building Construction.*

(B) LP-Gas containers installed on roofs shall be of 2000 gal (7.6 m^3) water capacity or less.

(C) The aggregate water capacity of LP-Gas containers installed on the roof or terrace of a building shall meet the following criteria:

(1) It shall not exceed 4000 gal (15.2 m^3) in one location.
(2) Additional installations on the same roof or terrace shall be located at least 50 ft (15 m) apart.

(D) An ASME container installed on the roof of a building shall always be filled by two operators, one at the controls of the vehicle supplying LP-Gas and another at the controls of the container.

(E) Containers shall be installed in external locations only.

(F) Where a fill line to the container is required, it shall be located entirely outside the building.

(G) The fill connection shall be located entirely outside the building.

(H) The fill connection shall be located at least 8 ft (2.4 m) above ground level.

(I) Containers shall be installed on a level surface.

(J) The container shall be secured to the building structure.

(K) The support of the container shall be designed to the same seismic criteria as the building.

(L) The roof on which the container is located shall be able to support the weight of the container filled with water, with the safety margins required by local codes.

(M) Containers shall be located in areas that have free air circulation, are at least 10 ft (3 m) from building openings (such as windows and doors), and are at least 20 ft (6.1 m) from air intakes of air-conditioning and ventilating systems.

(N) The location of containers shall allow access to all valves and controls and shall have enough surrounding area to allow the required maintenance.

(O) The location of the container shall have fixed stairs or another method to reach it.

(P) If the installation requires the use of more than one container, the distances between containers from Table 6.3.1.1 shall apply.

(Q) If the container location is higher than 23 ft (7 m) from the ground, or if the filling hose cannot be observed by the operators in its entire length, the container shall have a filling line constructed to withstand liquid transfer, and it shall have the following appurtenances:

(1) Filler valve *[see 5.7.4.1(D)]*
(2) Filler valve cap
(3) Two control valves
(4) Hydrostatic relief valve
(5) Venting line

(R) The liquid fill and vapor connections shall be conspicuously marked or labeled.

(S) A fire safety analysis shall be prepared in accordance with 6.27.3.

6.7 Installation of Container Appurtenances.

6.7.1 Reserved.

6.7.2 Installation of Pressure Relief Devices.

6.7.2.1 Pressure relief devices shall be installed so that the relief device is in direct communication with the vapor space of the container.

6.7.2.2 Pressure relief devices on cylinders shall be installed to minimize the possibility of relief device discharge impingement on the cylinder.

6.7.2.3 Pressure relief devices on the following ASME containers shall be so installed that any gas released is vented away from the container upward and unobstructed to the open air:

(1) Containers of 125 gal (0.5 m^3) or more water capacity installed in stationary service
(2) Portable storage containers
(3) Portable tanks
(4) Cargo tanks

6.7.2.4 Rain caps or other means shall be provided to minimize the possibility of the entrance of water or other extraneous matter into the relief device or any discharge piping. Provision shall be made for drainage where the accumulation of water is anticipated.

6.7.2.5 The rain cap or other protector shall be designed to remain in place, except during pressure relief device operation, and shall not restrict pressure relief device flow.

6.7.2.6 The design of the pressure relief valve drain opening shall provide the following:

(1) Protection of the container against flame impingement resulting from ignited product escaping from the drain opening
(2) Direction of the pressure relief valve drain opening so that an adjacent container, piping, or equipment is not subjected to flame impingement

6.7.2.7 Pressure relief valve discharge on each container of more than 2000 gal (7.6 m^3) water capacity shall be directed vertically upward and unobstructed to the open air.

6.7.2.8 Shutoff valves shall not be installed between pressure relief devices and the container unless a listed pressure relief valve manifold meeting the requirements of 6.7.2.9 is used.

6.7.2.9 Listed pressure relief valve manifolds shall be exempt from the requirements of 6.7.2.8 when the following conditions are met:

(1) Two or more pressure relief devices are installed in the manifold.
(2) Only one pressure relief device in the manifold is designed to shut off at any one time.
(3) The remaining pressure relief device(s) remains open and provides the rated relieving capacity required for the container.

6.7.2.10 Shutoff valves shall not be installed at the outlet of a pressure relief device or at the outlet of the discharge piping where discharge piping is installed.

6.7.2.11 The pressure relief valve discharge piping from underground containers of 2000 gal (7.6 m^3) or less water capacity shall extend beyond the manhole or housing or shall discharge into the manhole or housing, where the manhole or housing is equipped with ventilated louvers or their equivalent, in accordance with 5.7.8.4.

6.7.2.12 Pressure relief valve discharge on underground containers of more than 2000 gal (7.6 m^3) water capacity shall be piped vertically and directly upward to a point at least 7 ft (2.1 m) above the ground. *(See 6.7.2.13.)*

6.7.2.13 Pressure relief devices installed in underground containers in dispensing stations shall be piped vertically upward to a point at least 10 ft (3 m) above the ground.

6.7.2.14 Where installed, the discharge piping shall comply with 6.7.2.14(A) through 6.7.2.14(F).

(A) Piping shall be supported and protected against physical damage.

(B) Piping from aboveground containers shall be sized to provide the rate of flow specified in Table 5.7.2.6.

(C) Piping from underground containers shall be sized to provide the rate of flow specified in 5.7.2.8.

(D) Piping shall be metallic and have a melting point over 1500°F (816°C).

(E) Discharge piping shall be so designed that excessive force applied to the discharge piping results in breakage on the discharge side of the valve, rather than on the inlet side, without impairing the function of the valve.

(F) Return bends and restrictive pipe or tubing fittings shall not be used.

6.7.3 Reserved.

6.7.4 Reserved.

6.7.5 Reserved.

6.7.6 Reserved.

6.7.7 Reserved.

6.7.8 Reserved.

6.7.9 Reserved.

6.8 Regulators.

6.8.1 Regulator Installation.

6.8.1.1 First-stage, high-pressure, automatic changeover, integral 2 psi service, integral two-stage, and single-stage regulators where allowed shall be installed in accordance with 6.8.1.1(A) through 6.8.1.1(D).

(A) Regulators connected to single container permanent installations shall be installed with one of the following methods:

(1) Directly attached to the vapor service valve
(2) Attached to the vapor service valve with a flexible metallic connector

(B) Regulators connected to cylinders in other than stationary installations shall be installed with one of the following methods:

(1) Directly attached to the vapor service valve
(2) Attached to the vapor service valve with a flexible metallic connector
(3) Attached to the vapor service valve with a flexible hose connector

(C) Regulators connected to manifolded containers shall be installed with the following methods:

(1) Installations shall comply with 6.9.3.8.
(2) The regulator shall be directly attached or attached with a flexible metallic connector to the vapor service manifold piping outlet.
(3) The connection between the container service valve outlet and the inlet side of the manifold piping shall be installed with one of the following methods:
   (a) Directly attached
   (b) Attached with a flexible metallic connector
   (c) Attached with a flexible hose connector connected to a cylinder in other than stationary installations

(D) Regulators installed on vaporizer outlets shall be installed with one of the following methods:

(1) Directly attached
(2) Attached with a flexible metallic connector

(E) Regulators connected to underground or mounded containers shall be permitted to be attached to the vapor service valve with a flexible hose connector providing electrical isolation between the container and metallic piping system that complies with ANSI/UL 569, *Standard for Pigtails and Flexible Hose Connectors for LP-Gas*, and is recommended by the manufacturer for underground service.

6.8.1.2 First-stage regulators installed downstream of high-pressure regulators shall be exempt from the requirement of 6.8.1.1.

6.8.1.3* First-stage and high-pressure regulators shall be installed outside of buildings, except as follows:

(1) Regulators on cylinders installed indoors in accordance with Section 6.20
(2) Regulators on containers of less than 125 gal (0.5 m^3) water capacity for the purpose of being filled or in structures complying with Chapter 10
(3) Regulators on containers on LP-Gas vehicles complying with, and parked or garaged in accordance with, Chapter 11
(4) Regulators on containers used with LP-Gas stationary or portable engine fuel systems complying with Chapter 11
(5) Regulators on containers used with LP-Gas–fueled industrial trucks complying with 11.13.4
(6) Regulators on containers on LP-Gas–fueled vehicles garaged in accordance with Section 11.16
(7) Regulators on cylinders awaiting use, resale, or exchange when stored in accordance with Chapter 8

6.8.1.4 All regulators for outdoor installations shall be designed, installed, or protected so their operation will not be affected by the elements (freezing rain, sleet, snow, ice, mud, or debris).

(A) This protection shall be permitted to be integral with the regulator.

(B) Regulators used for portable industrial applications shall be exempt from the requirements of 6.8.1.4.

6.8.1.5 The point of discharge from the required pressure relief device on regulated equipment installed outside of buildings or occupiable structures in fixed piping systems shall be located not less than 3 ft (1 m) horizontally away from any building or occupiable structure opening below the level of discharge, and not beneath or inside any building or occupiable structure unless this space is not enclosed for more than 50 percent of its perimeter.

6.8.1.6 The point of discharge shall also be located not less than 5 ft (1.5 m) in any direction from any source of ignition, openings into direct-vent (sealed combustion system) appliances, or mechanical ventilation air intakes.

6.8.1.7 The discharge from the required pressure relief device of a second-stage regulator, other than a line pressure regulator, installed inside of buildings in fixed piping systems shall comply with the following:

(1) The discharge shall be directly vented with supported piping to the outside air.
(2) The vent line shall be at least the same nominal pipe size as the regulator vent connection pipe size.
(3) Where there is more than one regulator at a location, either each regulator shall have a separate vent to the outside or the vent lines shall be manifolded in accordance with accepted engineering practices to minimize back pressure in the event of high vent discharge.
(4) The material of the vent line shall comply with 5.8.3.
(5) The discharge outlet shall be located not less than 3 ft (1 m) horizontally away from any building opening below the level of such discharge.
(6) The discharge outlet shall also be located not less than 5 ft (1.5 m) in any direction from any source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes.
(7) The discharge outlet shall be designed, installed, or protected from blockage so it will not be affected by the elements (freezing rain, sleet, snow, ice, mud, or debris) or insects.

6.8.1.8 The requirement in 6.8.1.7 shall not apply to appliance regulators otherwise protected, to line pressure regulators listed as complying with ANSI Z21.80/CSA 6.22, *Standard for Line Pressure Regulators*, or to regulators used in connection with containers in buildings as provided for in 6.2.2(1), 6.2.2(2), 6.2.2(4), 6.2.2(5), and 6.2.2(6).

6.8.1.9 The requirement in 6.8.1.7 shall not apply to vaporizers.

6.8.1.10 Single-stage regulators shall be permitted to be used only on portable appliances and outdoor cooking appliances with input ratings of 100,000 Btu/hr (29 kW) maximum.

6.8.1.11 Line pressure regulators shall be installed in accordance with the requirements of NFPA 54, *National Fuel Gas Code.*

6.8.2 Selection of Pressure Regulators.

6.8.2.1 A two-stage regulator system, an integral two-stage regulator, or a 2 psi regulator system shall be required on all fixed piping systems that serve ½ psig (3.4 kPag) appliance systems [normally operated at 11 in. water column (2.7 kPag) pressure].

6.8.2.2 The requirement for two-stage regulation shall include fixed piping systems for appliances on recreational vehicles, mobile home installations, manufactured home installations, catering vehicles, and food service vehicle installations.

6.8.2.3 Single-stage regulators shall not be installed in fixed piping systems after June 30, 1997, except for installations covered in 6.8.2.4.

6.8.2.4 Single-stage regulators shall be permitted on small portable appliances and outdoor cooking appliances with input ratings of 100,000 Btu/hr (29 kW) or less.

6.8.2.5 Gas distribution systems utilizing multiple second-stage regulators shall be permitted to use a high-pressure regulator installed at the container, provided that a first-stage regulator is installed downstream of the high-pressure regulator and ahead of the second-stage regulators.

6.8.2.6 High-pressure regulators with an overpressure protection device and a rated capacity of more than 500,000 Btu/hr (147 kW) shall be permitted to be used in two-stage systems where the second-stage regulator incorporates an integral or separate overpressure protection device.

6.8.2.7 The overpressure protection device described in 6.8.2.6 shall limit the outlet pressure of the second-stage regulator to 2.0 psig (14 kPag) when the regulator seat disc is removed and with an inlet pressure equivalent to the maximum outlet pressure setting of the high-pressure regulator.

6.8.2.8 Systems consisting of listed components that provide an equivalent level of overpressure protection shall be exempt from the requirements of 6.8.2.6 and 6.8.2.7.

6.8.2.9 A 2 psi regulator system shall consist of a first-stage regulator and a 2 psi service regulator in compliance with the requirements of 5.8.1.14 in conjunction with a line pressure regulator that is in compliance with ANSI Z21.80/CSA 6.22, *Standard for Line Pressure Regulators.*

6.9 Piping Systems.

6.9.1 Piping System Service Limitations.

6.9.1.1 The physical state (vapor or liquid) and pressure at which LP-Gas is transmitted through piping systems shall be in accordance with 6.9.1.1(A) through 6.9.1.1(E).

(A) Outdoor LP-Gas liquid or vapor metallic piping systems shall have no pressure limitations.

(B) Outdoor underground LP-Gas liquid or vapor polyamide piping systems shall have pressure limitations as defined by the design pressure of the piping being installed.

(C) Polyethylene piping systems shall be limited to the following:

(1) Vapor service not exceeding 30 psig (208 kPag)
(2) Installation outdoors and underground

(D)* LP-Gas vapor at pressures exceeding 20 psig (138 kPag) or LP-Gas liquid shall not be piped into any building unless the installation is in accordance with one of the following:

(1) The buildings or structures are under construction or undergoing major renovation, and the temporary piping systems are in accordance with 6.20.2 and 6.20.12.
(2) The buildings or separate areas of the buildings are constructed in accordance with Chapter 10 and used exclusively to house the following:
   (a) Equipment for vaporization, pressure reduction, gas mixing, gas manufacturing, or distribution
   (b) Internal combustion engines, industrial processes, research and experimental laboratories, or equipment or processing having a similar hazard
   (c) Engine-mounted fuel vaporizers
(3) Industrial occupancies are in accordance with 6.9.1.2.

(E)* Corrugated stainless steel piping systems shall be limited to vapor service not exceeding the listed pressure rating of the product.

6.9.1.2* LP-Gas vapor fixed piping systems at pressures of 20 psig through 50 psig (138 kPag through 345 kPag) in industrial occupancies shall be approved and shall comply with 6.9.1.2(A) through 6.9.1.2(D).

(A) The industrial equipment shall require inlet pressures greater than 20 psig (138 kPag).

(B) Pressure relief valve protection shall be provided for the vapor piping system that will limit any overpressure in the piping system to not more than 10 percent of the design pressure of the system.

(C) Pressure relief valve discharge shall be vented directly to the outdoors.

(D) A low-temperature control system shall positively shut off the flow of LP-Gas into the vapor piping system when the temperature of the LP-Gas vapor is reduced to its condensation point at the maximum design operating pressure of the system.

6.9.1.3 Liquid piping systems in buildings or structures feeding a vaporizer other than those covered by 6.9.1.1(D) shall comply with the material requirements of Chapters 5 and 6.

6.9.2 Sizing of LP-Gas Vapor Piping Systems.

6.9.2.1 LP-Gas vapor piping systems downstream of the first-stage pressure regulator shall be sized so that all appliances operate within their manufacturer's specifications.

6.9.2.2 LP-Gas vapor piping systems shall be sized and installed to provide a supply of gas to meet the maximum demand of all gas utilization equipment using Table 15.1(a) through Table 15.1(q) or engineering methods.

6.9.3 Installation of Metallic Pipe, Tubing, and Fittings.

6.9.3.1* All metallic LP-Gas piping shall be installed in accordance with ASME B31.3, *Process Piping,* for normal fluid service, or in accordance with Section 6.9.

6.9.3.2 All welding and brazing of metallic piping shall be in accordance with ASME *Boiler and Pressure Vessel Code,* Section IX.

6.9.3.3 Metallic piping shall comply with 6.9.3.3(A) through 6.9.3.3(C).

(A) Piping used at pressures higher than container pressure, such as on the discharge side of liquid transfer pumps, shall be designed for a pressure rating of at least 350 psig (2.4 MPag).

(B) Vapor LP-Gas piping with operating pressures in excess of 125 psig (0.9 MPag) and liquid piping not covered by 6.9.3.3(A) shall be designed for a working pressure of at least 250 psig (1.7 MPag).

(C) Vapor LP-Gas piping subject to pressures of not more than 125 psig (0.9 MPag) shall be designed for a pressure rating of at least 125 psig (0.9 MPag).

6.9.3.4 Pressure relief valve discharge piping shall be exempt from the requirement of 6.9.3.3(C).

6.9.3.5 Metallic pipe joints shall be permitted to be threaded, flanged, welded, or brazed using pipe and fittings that comply with 5.9.3, 5.9.4, and 6.9.3.5(A) through 6.9.3.5(H).

(A) Metallic threaded, welded, and brazed pipe joints shall be in accordance with Table 6.9.3.5(A).

Table 6.9.3.5(A) Types of Metallic Pipe Joints in LP-Gas Service

Service	Schedule 40	Schedule 80
Liquid	Welded or brazed	Threaded, welded, or brazed
Vapor, ≤125 psig (≤0.9 MPag)	Threaded, welded, or brazed	Threaded, welded, or brazed
Vapor, ≥125 psig (≥0.9 MPag)	Welded or brazed	Threaded, welded, or brazed

(B) Fittings and flanges shall be designed for a pressure rating equal to or greater than the required working pressure of the service for which they are used.

(C) Brazed joints shall be made with a brazing material having a melting point exceeding 1000°F (538°C).

(D) Gaskets used to retain LP-Gas in flanged connections in piping shall be resistant to the action of LP-Gas.

(E) Gaskets shall be made of metal or material confined in metal having a melting point over 1500°F (816°C) or shall be protected against fire exposure.

(F) When a flange is opened, the gasket shall be replaced.

(G) Aluminum O-rings and spiral-wound metal gaskets shall be permitted to be used.

(H) Nonmetallic gaskets used in insulating fittings shall be permitted to be used.

6.9.3.6 Metallic tubing joints shall be flared or brazed using tubing and fittings in accordance with 5.9.3 and 5.9.4.

6.9.3.7 Piping in systems shall be run as directly as is practical from one point to another, with as few fittings as practical.

6.9.3.8 Where condensation of vapor can occur, piping shall be sloped back to the container or means shall be provided for revaporizing the condensate.

6.9.3.9 Piping systems, including the interconnection of permanently installed containers, shall compensate for expansion, contraction, jarring, vibration, and settling.

(A) Flexible metallic connectors shall be permitted to be used.

(B) The use of nonmetallic pipe, tubing, or hose for permanently interconnecting containers shall be prohibited.

6.9.3.10 Aboveground piping shall be supported and protected against physical damage by vehicles.

6.9.3.11 The portion of aboveground piping in contact with a support or a corrosion-causing substance shall be protected against corrosion.

6.9.3.12 Buried metallic pipe and tubing shall be installed underground with a minimum 12 in. (300 mm) of cover.

(A) The minimum cover shall be increased to 18 in. (460 mm) if external damage to the pipe or tubing from external forces is likely to result.

(B) If a minimum 12 in. (300 mm) of cover cannot be maintained, the piping shall be installed in conduit or shall be bridged (shielded).

6.9.3.13 Where underground piping is beneath driveways, roads, or streets, possible damage by vehicles shall be taken into account.

6.9.3.14 Metallic piping shall be protected against corrosion in accordance with 6.9.3.14(A) through 6.9.3.14(C).

(A) Piping and tubing of 1 in. (25 mm) nominal diameter or smaller shall be protected in accordance with 6.17.1 or 6.17.2.

(B) Piping and tubing larger than 1 in. (25 mm) nominal diameter and installed above ground shall be protected in accordance with 6.17.1.

(C) Steel piping larger than 1 in. (25 mm) nominal diameter installed underground shall have a cathodic protection system in accordance with 6.17.2(C) unless technical justification is approved by the authority having jurisdiction.

6.9.3.15 LP-Gas piping shall not be used as a grounding electrode.

6.9.3.16 Underground metallic piping, tubing, or both that convey LP-Gas from a gas storage container shall be provided with dielectric fittings installed above ground and outdoors at the building to electrically isolate it from the aboveground portion of the fixed piping system that enters a building.

6.9.4 Installation of Polyamide and Polyethylene Pipe, Tubing, and Fittings.

6.9.4.1 Polyethylene and polyamide pipe, tubing, and fittings shall be installed outdoors underground only.

6.9.4.2 Polyethylene and polyamide pipe and tubing shall be buried as follows:

(1) With a minimum of 12 in. (300 mm) of cover
(2) With a minimum of 18 in. (460 mm) of cover if external damage to the pipe or tubing is likely to result
(3) With piping installed in conduit or bridged (shielded) if a minimum of 12 in. (300 mm) of cover cannot be provided

6.9.4.3 Assembled anodeless risers shall be used to terminate underground polyamide and polyethylene fixed piping systems above ground.

(A) The horizontal portion of risers shall be buried at least 12 in. (300 mm) below grade, and the casing material used for the risers shall be protected against corrosion in accordance with Section 6.17.

(B) Either the aboveground portion of the riser casing shall be provided with a plastic sleeve inside the riser casing, or the pipe or tubing shall be centered in the riser casing.

(C) Factory-assembled risers shall be sealed and leak tested by the manufacturer.

6.9.4.4 Field-assembled risers shall be supplied only in kit form with all necessary hardware for installation.

(A) Field-assembled risers shall comply with the following:

(1) They shall be design certified.
(2) They shall be sealed and pressure tested by the installer.
(3) They shall be assembled and installed in accordance with the riser manufacturer's instructions.

(B) The casing of the riser shall be constructed of one of the following materials:

(1) ASTM A 53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless,* Schedule 40 steel pipe
(2) ASTM A 513, *Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing,* mechanical steel tubing with a minimum wall thickness of 0.073 in. (1.9 mm)
(3) Flexible metal tubing with a minimum crush strength of 1000 lb (453.6 kg) and a tensile strength of 300 lb (136 kg), including the transition connection as tested by the manufacturer

6.9.4.5* Polyamide and polyethylene piping shall be designed to sustain and minimize the thrust forces caused by contraction or expansion of the piping or by anticipated external or internal loading.

6.9.4.6 An electrically continuous corrosion-resistant tracer wire (minimum AWG 14) or tape shall be buried with the polyamide or polyethylene pipe to facilitate locating the pipe.

(A) One end of the tracer wire shall be brought above ground at a building wall or riser.

(B) The tracer wire or tape shall not be in direct contact with the polyamide or polyethylene pipe.

6.9.4.7 Polyamide and polyethylene piping that is installed in a vault, the dome of an underground container, or any other belowground enclosure shall be completely encased in one of the following:

(1) Gastight metal pipe and fittings that are protected from corrosion
(2) An anodeless riser

6.9.4.8 Polyamide and polyethylene piping shall be installed in accordance with the manufacturer's installation instructions.

6.9.4.9 Where polyamide or polyethylene pipe or tubing is inserted into an existing steel pipe, it shall comply with 6.9.4.9(A) and 6.9.4.9(B).

(A) The polyamide or polyethylene pipe or tubing shall be protected from being damaged during the insertion process.

(B) The leading end of the polyamide or polyethylene pipe or tubing being inserted shall also be closed prior to insertion.

6.9.4.10 Polyamide and polyethylene pipe that is not encased shall have a minimum wall thickness of 0.090 in. (2.3 mm).

6.9.4.11 Polyamide or polyethylene pipe with an outside diameter of 0.875 in. (22.2 mm) or less shall be permitted to have a minimum wall thickness of 0.062 in. (1.6 mm).

6.9.4.12 Each imperfection or damaged piece of polyamide or polyethylene pipe shall be replaced by fusion or mechanical fittings.

6.9.4.13 Repair clamps shall not be used to cover damaged or leaking sections.

6.9.5 Valves in Polyamide and Polyethylene Piping Systems.

6.9.5.1 Valves in polyamide and polyethylene piping shall comply with following:

(1) Valves shall protect the pipe from excessive torsional or shearing loads when the valve is operated.
(2) Valve boxes shall be installed so as to minimize transmitting external loads to the valve or pipe.

6.9.5.2 Valves shall be recommended for LP-Gas service by the manufacturer.

6.9.5.3 Valves shall be manufactured from thermoplastic materials fabricated from materials listed in ASTM D 2513, *Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings,* that have been shown to be resistant to the action of LP-Gas, or from metals protected to minimize corrosion in accordance with Section 6.17.

6.9.6 Flexible Connectors.

6.9.6.1 Flexible connectors shall be installed in accordance with the manufacturer's instructions.

6.9.6.2 Flexible metallic connectors shall not exceed 5 ft (1.5 m) in overall length when used with liquid or vapor piping on stationary containers of 2000 gal (7.6 m^3) water capacity or less.

6.10 Remote Shutoff Actuation.

6.10.1 Where LP-Gas vapor is used as a pressure source for activating the remote shutoff mechanisms of internal valves and emergency shutoff valves, the following shall apply:

(1) Actuators and pressure supply line components shall be compatible with LP-Gas vapor.
(2) Supply line piping materials shall be limited to a maximum of ⅜ in. (9.0 mm) outside diameter.
(3)*Supply pressure shall be controlled to prevent condensation of the LP-Gas vapor.
(4) The LP-Gas supply maximum flow rate to the system shall not exceed that from a No. 54 drill orifice.

6.10.2 Where compressed air is used as a pressure source for activating internal valves and emergency shutoff valves, the air shall be clean and kept at a moisture level that will not prevent the system from operating.

6.11 Internal Valves.

6.11.1 The requirements of 6.11.2 through 6.11.5 shall be required for internal valves in liquid service that are installed in containers of over 4000 gal (15.2 m^3) water capacity by July 1, 2003.

6.11.2 Internal valves shall be installed in accordance with 5.7.4.2 and Table 5.7.4.2 on containers of over 4000 gal (15.2 m^3) water capacity.

6.11.3 Thermal Activation.

6.11.3.1 Automatic shutdown of internal valves in liquid service shall be provided using thermal (fire) actuation.

6.11.3.2 The thermal sensing element of the internal valve shall be within 5 ft (1.5 m) of the internal valve.

6.11.4 Remote Shutdown Station.

6.11.4.1 At least one remote shutdown station for internal valves in liquid service shall be installed not less than 25 ft (7.6 m) or more than 100 ft (30 m) from the liquid transfer point.

6.11.4.2 This requirement shall be retroactive to all internal valves required by the code.

6.11.5 Emergency remote shutdown stations shall be identified by a sign, visible from the point of transfer, incorporating the words "Propane — Container Liquid Valve Emergency Shutoff" in block letters of not less than 2 in. (51 mm) in height on a background of contrasting color to the letters.

6.12 Emergency Shutoff Valves.

6.12.1 On new installations and on existing installations, stationary container storage systems with an aggregate water capacity of more than 4000 gal (15.2 m^3) utilizing a liquid transfer line that is 1½ in. (39 mm) or larger, and a pressure equalizing vapor line that is 1¼ in. (32 mm) or larger, shall be equipped with emergency shutoff valves.

6.12.2 An emergency shutoff valve shall be installed in the transfer lines of the fixed piping transfer system within 20 ft (6 m) of lineal pipe from the nearest end of the hose or swivel-type piping connections.

6.12.3 When the flow is only into the container, a backflow check valve shall be permitted to be used in lieu of an emergency shutoff valve if installed in the piping transfer system downstream of the hose or swivel-type piping connections.

6.12.4 The backflow check valve shall have a metal-to-metal seat or a primary resilient seat with metal backup, not hinged with combustible material, and shall be designed for this specific application.

6.12.5 Where there are two or more liquid or vapor lines with hoses or swivel-type piping connected of the sizes designated, an emergency shutoff valve or a backflow check valve, where allowed, shall be installed in each leg of the piping.

6.12.6 Emergency shutoff valves shall be installed so that the temperature-sensitive element in the valve, or a supplemental temperature-sensitive element that operates at a maximum temperature of 250°F (121°C) that is connected to actuate the valve, is not more than 5 ft (1.5 m) from the nearest end of the hose or swivel-type piping connected to the line in which the valve is installed.

6.12.7 Temperature-sensitive elements of emergency shutoff valves shall not be painted, nor shall they have any ornamental finishes applied after manufacture.

6.12.8* The emergency shutoff valves or backflow check valves shall be installed in the fixed piping so that any break resulting from a pull will occur on the hose or swivel-type piping side of the connection while retaining intact the valves and piping on the plant side of the connection.

Paragraph 6.12.9 was revised by a tentative interim amendment (TIA). See page 1.

6.12.9 Where emergency shutoff valves are required to be installed in accordance with 6.12.2, a means shall be incorporated to actuate the emergency shutoff valves in the event of a break of the fixed piping resulting from a pull on the hose.

6.12.10 Emergency shutoff valves required by the code shall be tested annually for the functions required by 5.12.2.3(2) and (3), and the results of the test shall be documented.

6.12.11 Backflow check valves installed in lieu of emergency shutoff valves shall be checked annually for proper operation, and the results of the test shall be documented.

6.12.12 All new and existing emergency shutoff valves shall comply with 6.12.12.1 through 6.12.12.3.

6.12.12.1 Each emergency shutoff valve shall have at least one clearly identified and easily accessible manually operated remote emergency shutoff device.

6.12.12.2 The shutoff device shall be located not less than 25 ft (7.6 m) or more than 100 ft (30 m) in the path of egress from the emergency shutoff valve.

6.12.12.3 Where an emergency shutoff valve is used in lieu of an internal valve in compliance with 5.7.4.2(D)(2), the remote shutoff device shall be installed in accordance with 6.11.4 and 6.11.5.

6.12.13 Emergency shutoff valves for railroad tank car transfer systems shall be in accordance with 6.19.2.6, 6.28.4, 7.2.3.7, and 7.2.3.8.

6.13 Hydrostatic Relief Valve Installation. A hydrostatic relief valve or a device providing pressure-relieving protection shall be installed in each section of piping and hose in which liquid LP-Gas can be isolated between shutoff valves, so as to relieve the pressure that could develop from the trapped liquid to a safe atmosphere or product-retaining section.

6.14 Testing New or Modified Piping Systems.

6.14.1 Piping Systems.

6.14.1.1 After installation or modification, piping systems (including hose) shall be proven free of leaks by performing a pressure test at not less than the normal operating pressure.

6.14.1.2 LP-Gas shall be permitted to be used as the test medium.

6.14.2 Branches.

6.14.2.1 Where new branches are installed, only the newly installed branch(es) shall be required to be pressure tested.

6.14.2.2 Connections between the new piping and the existing piping shall be tested with a noncorrosive leak-detecting fluid or approved leak-detecting methods.

6.14.3 Piping within the scope of NFPA 54, *National Fuel Gas Code*, shall be pressure tested in accordance with that code.

6.14.4 Tests shall not be made with a flame.

6.15 Leak Check for Vapor Systems.

6.15.1* All vapor piping systems operating at 20 psig (138 kPag) or less in stationary installations shall be checked for leakage in accordance with 6.15.2 through 6.15.5.

6.15.2* Immediately after the gas is turned on into a new system or into a system that has been initially restored after an interruption of service, the piping system shall be checked for leakage.

6.15.3 Piping within the scope of NFPA 54, *National Fuel Gas Code*, shall be checked for leakage in accordance with that code.

6.15.4* Gas systems within the scope of 49 CFR 192 or those outside the scope of NFPA 54 shall be exempt from the requirements of this section.

6.15.5 Where leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.

6.16 Installation in Areas of Heavy Snowfall.

6.16.1* In areas where the ground snow load is equal to or exceeds 175 psf (855 kg/m^2), piping, regulators, meters, and other equipment installed in the piping system shall be protected from the forces of accumulated snow.

6.17* Corrosion Protection.

6.17.1 All materials and equipment installed above ground shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion.

6.17.2 Except for underground and mounded containers (*see 6.6.6*), all materials and equipment that are buried or mounded shall comply with one of the requirements in 6.17.2(A) through 6.17.2(C).

(A) Materials and equipment shall be made of corrosion-resistant material that are suitable for the environment in which they will be installed.

(B) Materials and equipment shall be manufactured with a corrosion-resistant coating or have a coating applied prior to being placed into service.

(C) Materials and equipment shall have a cathodic protection system installed and maintained in accordance with 6.17.3.

6.17.3 Where installed, cathodic protection systems shall comply with 6.17.3.1 through 6.17.3.3.

6.17.3.1* Cathodic protection systems installed in accordance with this code shall be monitored by testing, the results shall be documented, and confirming tests shall be described by one of the following:

(1) Producing a voltage of –0.85 volt or more negative, with reference to a saturated copper–copper sulfate half cell
(2) Producing a voltage of –0.78 volt or more negative, with reference to a saturated KCl calomel half cell
(3) Producing a voltage of –0.80 volt or more negative, with reference to a silver–silver chloride half cell
(4) Any other method described in Appendix D of 49 CFR 192

6.17.3.2* Sacrificial anodes shall be tested in accordance with the following schedule.

(1) Upon installation of the cathodic protection system, unless prohibited by climatic conditions, in which case testing shall be done within 180 days after the installation of the system.
(2) For continued verification of the effectiveness of the system, 12 to 18 months after the initial test.
(3) Upon successful verification testing and in consideration of previous test results, periodic follow-up testing shall be performed at intervals not to exceed 36 months.
(4) Systems failing a test shall be repaired as soon as practical unless climatic conditions prohibit this action, in which case the repair shall be made not more than 180 days thereafter. The testing schedule shall be restarted as required in 6.17.3.2(1) and 6.17.3.2(2), and the results shall comply with 6.17.3.2.
(5) Documentation of the results of the two most recent tests shall be retained.

6.17.3.3* Where an impressed current cathodic protection system is installed, it shall be inspected and tested in accordance with the schedule described in 6.17.3.3(A) and 6.17.3.3(B).

(A) All sources of impressed current shall be inspected and tested at intervals not exceeding 2 months.

(B) All impressed current cathodic protection installations shall be inspected and tested annually.

6.17.4 Corrosion protection of all other materials shall be in accordance with accepted engineering practice.

6.18 Equipment Installation.

6.18.1 Reserved.

6.18.2 Pump Installation.

6.18.2.1 Pumps shall be installed in accordance with the pump manufacturers' installation instructions.

6.18.2.2 Installation shall be made so that the pump casing is not subjected to excessive strains transmitted to it by the suction and discharge piping, which shall be accomplished as follows:

(1) By piping design
(2) By the use of flexible metallic connectors that do not exceed 36 in. (1 m) in overall length
(3) By other means

6.18.2.3 Positive displacement pumps shall incorporate a bypass valve or recirculating device to limit the normal operating discharge pressure.

(A) The bypass valve or recirculating device to limit the normal operating discharge pressure shall discharge either into a storage container or into the pump inlet.

(B) If the bypass valve or recirculating device is equipped with a shutoff valve, a secondary device shall be required and designed to do one of the following:

(1) Operate at not more than 400 psig (2.8 MPag)
(2) Operate at a pressure of 50 psig (345 kPag) above the operating pressure where the design pressure exceeds 350 psig (2.4 MPag)

(C) The secondary device shall be incorporated, if not integral with the pump, in the pump piping and shall be designed or installed so that it cannot be rendered inoperative and shall discharge either into a storage container or into the pump inlet.

(D) A pump operating control or disconnect switch shall be located near the pump, and remote control points shall be provided for other plant operations such as container filling, loading or unloading of cargo tank vehicles and railroad tank cars, or operation of the engine fuel dispenser.

6.18.3 Compressor Installation.

6.18.3.1 Compressors shall be installed in accordance with the compressor manufacturers' installation instructions.

6.18.3.2 Installation shall be made so that the compressor housing is not subjected to excessive stresses transmitted to it by the suction and discharge piping. Where used to provide flexibility in the piping system, flexible metallic connectors or metallic-protected flexible hose connectors shall not exceed 36 in. (1 m) in overall total length.

6.18.3.3 Engines used to drive portable compressors shall be equipped with exhaust system spark arresters and shielded ignition systems.

6.18.3.4 Where the compressor is not equipped with an integral means to prevent the LP-Gas liquid from entering the suction, a liquid trap shall be installed in the suction piping as close to the compressor as practical.

6.18.3.5 Portable compressors used with temporary connections shall be excluded from the requirement in 6.18.3.4 unless used to unload railroad tank cars.

6.18.4 Installation of Strainers. Strainers shall be installed so that the strainer element can be removed without removing equipment or piping.

6.18.5 Installation of Meters.

6.18.5.1 Liquid or vapor meters shall be installed in accordance with the manufacturers' installation instructions.

6.18.5.2 Liquid meters shall be installed so that the meter housing is not subject to excessive strains from the connecting piping. If not provided in the piping design, the use of flexible connectors shall be permitted.

6.18.5.3 Vapor meters shall be installed so as to minimize the possibility of physical damage.

6.19 Bulk Plant and Industrial Plant LP-Gas Systems.

6.19.1 Operations and Maintenance. The provisions of Chapter 14 shall apply to new and existing bulk plants and industrial plants.

6.19.2 Installation of Liquid Transfer Facilities.

6.19.2.1 Points of transfer or the nearest part of a structure housing transfer operations shall be located in accordance with 6.5.2.1 and 6.5.2.2.

6.19.2.2 Buildings used exclusively for housing pumps or vapor compressors shall be located in accordance with 6.5.2.2, considering the building as one that houses a point of transfer.

6.19.2.3 Liquid transfer facilities at rail sidings shall comply with 6.19.2.3(A) through 6.19.2.3(C).

(A) The track of the railroad siding or the roadway surface at the transfer points shall be relatively level.

(B) Clearances from buildings, structures, or stationary containers shall be provided for the siding or roadway approaches to the unloading or loading points to prevent the railroad tank car or cargo tank vehicle from contacting buildings, structures, or stationary containers.

(C) Barriers shall be provided at the ends of railroad sidings.

6.19.2.4 Pumps and compressors shall comply with 6.19.2.4(A) through 6.19.2.4(C).

(A) Compressors used for liquid transfer normally shall withdraw vapor from the vapor space of the container being filled and discharge into the vapor space of the container from which the withdrawal is being made.

(B) An operating control or disconnect switch shall be located nearby.

(C) Remote shutoff controls shall be provided as necessary in other liquid transfer systems.

6.19.2.5* Bulk plant and industrial plant liquid inlet piping shall be designed to prevent debris from impeding the action of valves and other components of the piping system. This requirement shall be effective for existing installations on July 1, 2011.

6.19.2.6 Where a hose or swivel-type piping is used for liquid transfer, it shall be protected as follows:

(1) An emergency shutoff valve shall be installed at the railroad tank car end of the hose or swivel-type piping where flow into or out of the railroad tank car is possible.
(2) An emergency shutoff valve or a backflow check valve shall be installed on the railroad tank car end of the hose or swivel-type piping where flow is only into the railroad tank car.
(3)*Where a facility hose is used at a LP-Gas bulk plant or industrial plant to transfer LP-Gas liquid from a cargo tank vehicle in non-metered service to a bulk plant or industrial plant, the facility hose or the facility shall be equipped with an emergency discharge control system that provides a means to shut down the flow of LP-Gas caused by the complete separation of the facility hose within 20 seconds and without the need for human intervention.

6.19.2.7 Transfer hose larger than ½ in. (12 mm) internal diameter shall not be used for making connections to individual containers being filled indoors.

6.19.2.8 If gas is to be discharged from containers inside a building, the provisions of 7.3.2.1 shall apply.

6.19.3 Installation of Electrical Equipment. Installation of electrical equipment shall comply with 6.23.2.

6.19.4 Security and Protection Against Tampering for Section 6.19 and Section 6.25 Systems.

6.19.4.1 The following security measures shall be provided to minimize the possibility of entry by unauthorized persons:

(1) Security awareness training
(2) Limitation of unauthorized access to plant areas that include container appurtenances, pumping equipment, loading and unloading facilities, and container filling facilities

6.19.4.2 Areas that include features required in 6.19.4.1(2) shall be enclosed with a minimum 6 ft (1.8 m) high industrial-type fence, chain-link fence, or equivalent protection.

(A) The enclosure shall have at least two means of emergency egress, except as follows:

(1) The fenced or otherwise enclosed area is not over 100 ft^2 (9 m^2).
(2) The point of transfer is within 3 ft (1 m) of the gate.
(3) Containers are not filled within the enclosure.

(B) Clearance of at least 3 ft (1 m) shall be provided to allow emergency access to the required means of egress.

(C) Fencing shall not be required where devices are provided that can be locked in place and prevent unauthorized operation of valves, equipment, and appurtenances.

6.19.4.3 Where guard service is provided, it shall be extended to the LP-Gas installation, and the requirements of Section 4.4 shall apply to guard personnel.

6.19.5 Lighting. If operations are normally conducted during other than daylight hours, lighting shall be provided to illuminate storage containers, containers being loaded, control valves, and other equipment.

6.19.6 Ignition Source Control. Ignition source control shall comply with Section 6.23.

6.20 LP-Gas Systems in Buildings or on Building Roofs or Exterior Balconies.

6.20.1 Application.

6.20.1.1 Section 6.20 shall apply to the installation of the following LP-Gas systems in buildings or structures:

(1) Cylinders inside of buildings or on the roofs or exterior balconies of buildings
(2) Systems in which the liquid is piped from outside containers into buildings or onto the roof

6.20.1.2 The phrase *cylinders in use* shall mean connected for use.

(A) The use of cylinders indoors shall be only for the purposes specified in 6.20.4 through 6.20.10.

(B) The use of cylinders indoors shall be limited to those conditions where operational requirements make the indoor use of cylinders necessary and location outside is impractical.

(C) The use of cylinders on roofs shall be limited to those conditions where operational requirements make the use of cylinders necessary and location other than on roofs of buildings or structures is impractical.

(D) Liquid LP-Gas shall be piped into buildings or structures only for the purposes specified in 6.9.1.1(D).

6.20.1.3 Storage of cylinders awaiting use shall be in accordance with Chapter 8.

6.20.1.4 Transportation of cylinders within a building shall be in accordance with 6.20.3.6.

6.20.1.5 The following provisions shall be required in addition to those specified in Sections 6.2 and 6.3:

(1) Liquid transfer systems shall be in accordance with Chapter 7.
(2) Engine fuel systems used inside buildings shall be in accordance with Chapter 11.
(3) LP-Gas transport or cargo tank vehicles stored, serviced, or repaired in buildings shall be in accordance with Chapter 9.

6.20.2 Additional Equipment Requirements for Cylinders, Equipment, Piping, and Appliances Used in Buildings, Building Roofs, and Exterior Balconies.

6.20.2.1 Cylinders shall be in accordance with the following:

(1) Cylinders shall not exceed 245 lb (111 kg) water capacity [nominal 100 lb (45 kg) propane capacity] each.
(2) Cylinders shall comply with other applicable provisions of Section 5.2, and they shall be equipped as provided in Section 5.7.
(3) Cylinders shall be marked in accordance with 5.2.8.1 and 5.2.8.2.
(4) Cylinders with propane capacities greater than 2 lb (0.9 kg) shall be equipped as provided in Table 5.7.4.1(D), and an excess-flow valve shall be provided for vapor service when used indoors.
(5) Cylinder valves shall be protected in accordance with 5.2.6.1.
(6) Cylinders having water capacities greater than 2.7 lb (1.2 kg) and connected for use shall stand on a firm and substantially level surface.
(7) Cylinders shall be secured in an upright position if necessary.
(8) Cylinders and the valve-protecting devices used with them shall be oriented to minimize the possibility of impingement of the pressure relief device discharge on the cylinder and adjacent cylinders.

6.20.2.2 Manifolds and fittings connecting cylinders to pressure regulator inlets shall be designed for at least 250 psig (1.7 MPag) service pressure.

6.20.2.3 Piping shall comply with Section 5.9 and shall have a pressure rating of 250 psig (1.7 MPag).

6.20.2.4 Liquid piping and vapor piping at pressures above 125 psig (0.9 MPag) shall be installed in accordance with 6.9.3.

6.20.2.5 Hose, hose connections, and flexible connectors shall comply with the following:

(1) Hose used at pressures above 5 psig (34 kPag) shall be designed for a pressure of at least 350 psig (2.4 MPag).
(2) Hose used at a pressure of 5 psig (34 kPag) or less and used in agricultural buildings not normally occupied by the public shall be designed for the operating pressure of the hose.
(3) Hose shall comply with 5.9.6.
(4) Hose shall be installed in accordance with 6.21.3.
(5) Hose shall be as short as practical, without kinking or straining the hose or causing it to be close enough to a burner to be damaged by heat.
(6) Hoses greater than 10 ft (3 m) in length shall be protected from damage.

6.20.2.6* Portable heaters, including salamanders, shall comply with the following:

(1) Portable heaters shall be equipped with an approved automatic device to shut off the flow of gas to the main burner and to the pilot, if used, in the event of flame extinguishment or combustion failure.
(2) Portable heaters shall be self-supporting unless designed for cylinder mounting.
(3) Portable heaters shall not be installed utilizing cylinder valves, connectors, regulators, manifolds, piping, or tubing as structural supports.
(4) Portable heaters having an input of more than 50,000 Btu/hr (53 MJ/hr) shall be equipped with either a pilot that must be lighted and proved before the main burner can be turned on or an approved electric ignition system.

6.20.2.7 The provisions of 6.20.2.6 shall not be applicable to the following:

(1) Tar kettle burners, hand torches, or melting pots
(2) Portable heaters with less than 7500 Btu/hr (8 MJ/hr) input if used with cylinders having a maximum water capacity of 2.7 lb (1.2 kg) and filled with not more than 16.8 oz (0.522 kg) of LP-Gas

6.20.3 Installation Requirements for Cylinders, Equipment, Piping, and Appliances in Buildings, Building Roofs, and Exterior Balconies.

6.20.3.1 Cylinders having water capacities greater than 2.7 lb (1.2 kg) and connected for use shall stand on a firm and substantially level surface, and, if necessary, they shall be secured in an upright position.

6.20.3.2 Cylinders, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to the following:

(1) Abnormally high temperatures (such as might result from exposure to convection and radiation from heating equipment or installation in confined spaces)
(2) Physical damage
(3) Tampering by unauthorized persons

6.20.3.3 Heat-producing equipment shall be installed with clearance to combustibles in accordance with the manufacturer's installation instructions.

6.20.3.4 Heat-producing equipment shall be located and used to minimize the possibility of the ignition of combustibles.

6.20.3.5 Where located on a floor, roof, or balcony, cylinders shall be secured to prevent falling over the edge.

6.20.3.6 Transportation (movement) of cylinders having water capacities greater than 2.7 lb (1.2 kg) within a building shall be restricted to movement directly associated with the uses covered by Section 6.20.

(A) Valve outlets on cylinders having water capacities greater than 2.7 lb (1.2 kg) shall be tightly plugged, capped, or sealed with a listed quick-closing coupling or a listed quick-connect coupling.

(B) Only emergency stairways not normally used by the public shall be used, and precautions shall be taken to prevent the cylinder from falling down the stairs.

(C) Freight or passenger elevators shall be permitted to be used when occupied only by those engaged in moving the cylinder.

6.20.4 Buildings Under Construction or Undergoing Major Renovation.

6.20.4.1 Where cylinders are used and transported in buildings or structures under construction or undergoing major renovation and such buildings are not occupied by the public, the requirements of 6.20.4.2 through 6.20.4.10 shall apply.

6.20.4.2 The use and transportation of cylinders in the unoccupied portions of buildings or structures under construction or undergoing major renovation that are partially occupied by the public shall be approved by the authority having jurisdiction.

6.20.4.3 Cylinders, equipment, piping, and appliances shall comply with 6.20.2.

6.20.4.4 Heaters used for temporary heating shall be located at least 6 ft (1.8 m) from any cylinder. *(See 6.20.4.5 for an exception to this requirement.)*

6.20.4.5 Integral heater-cylinder units specifically designed for the attachment of the heater to the cylinder, or to a supporting standard attached to the cylinder, and designed and installed to prevent direct or radiant heat application to the cylinder shall be exempt from the spacing requirement of 6.20.4.4.

6.20.4.6 Blower-type and radiant-type units shall not be directed toward any cylinder within 20 ft (6.1 m).

6.20.4.7 If two or more heater-cylinder units of either the integral or nonintegral type are located in an unpartitioned area on the same floor, the cylinder(s) of each such unit shall be separated from the cylinder(s) of any other such unit by at least 20 ft (6.1 m).

6.20.4.8 If heaters are connected to cylinders manifolded together for use in an unpartitioned area on the same floor, the total water capacity of cylinders manifolded together serving any one heater shall not be greater than 735 lb (333 kg) [nominal 300 lb (136 kg) propane capacity]. If there is more than one such manifold, it shall be separated from any other by at least 20 ft (6.1 m).

6.20.4.9 Where cylinders are manifolded together for connection to a heater(s) on another floor, the following shall apply:

(1) Heaters shall not be installed on the same floors with manifolded cylinders.
(2) The total water capacity of the cylinders connected to any one manifold shall not be greater than 2450 lb (1111 kg) [nominal 1000 lb (454 kg) propane capacity].
(3) Manifolds of more than 735 lb (333 kg) water capacity [nominal 300 lb (136 kg) propane capacity], if located in the same unpartitioned area, shall be separated from each other by at least 50 ft (15 m).

6.20.4.10 Where compliance with the provisions of 6.20.4.6 through 6.20.4.9 is impractical, alternate installation provisions shall be allowed with the approval of the authority having jurisdiction.

6.20.5 Buildings Undergoing Minor Renovation When Frequented by the Public.

6.20.5.1 Cylinders used and transported for repair or minor renovation in buildings frequented by the public during the hours the public normally occupies the building shall comply with the following:

(1) The maximum water capacity of individual cylinders shall be 50 lb (23 kg) [nominal 20 lb (9.1 kg) propane capacity], and the number of cylinders in the building shall not exceed the number of workers assigned to the use of the propane.
(2) Cylinders having a water capacity greater than 2.7 lb (1.2 kg) shall not be left unattended.

6.20.5.2 During the hours the building is not open to the public, cylinders used and transported within the building for repair or minor renovation and with a water capacity greater than 2.7 lb (1.2 kg) shall not be left unattended.

6.20.6 Buildings Housing Industrial Occupancies.

6.20.6.1 Cylinders used in buildings housing industrial occupancies for processing, research, or experimental purposes shall comply with 6.20.6.1(A) and 6.20.6.1(B).

(A) If cylinders are manifolded together, the total water capacity of the connected cylinders shall be not more than 735 lb (333 kg) [nominal 300 lb (136 kg) propane capacity]. If there is more than one such manifold in a room, it shall be separated from any other by at least 20 ft (6.1 m).

(B) The amount of LP-Gas in cylinders for research and experimental use in the building shall be limited to the smallest practical quantity.

6.20.6.2 The use of cylinders to supply fuel for temporary heating in buildings housing industrial occupancies with essentially noncombustible contents shall comply with the requirements in 6.20.4 for cylinders in buildings under construction.

6.20.6.3 The use of cylinders to supply fuel for temporary heating shall be permitted only where portable equipment for space heating is essential and a permanent heating installation is not practical.

6.20.7 Buildings Housing Educational and Institutional Occupancies.

6.20.7.1 The use of cylinders in classrooms shall be prohibited unless they are used temporarily for classroom demonstrations in accordance with 6.20.9.1.

6.20.7.2 Where cylinders are used in buildings housing educational and institutional laboratory occupancies for research and experimental purposes, the following shall apply:

(1) The maximum water capacity of individual cylinders used shall be 50 lb (23 kg) [nominal 20 lb (9.1 kg) propane capacity] if used in educational occupancies and 12 lb (5.4 kg) [nominal 5 lb (2 kg) propane capacity] if used in institutional occupancies.
(2) If more than one such cylinder is located in the same room, the cylinders shall be separated by at least 20 ft (6.1 m).
(3) Cylinders not connected for use shall be stored in accordance with Chapter 8.
(4) Cylinders shall not be stored in a laboratory room.

6.20.8 Temporary Heating and Food Service Appliances in Buildings in Emergencies.

6.20.8.1 Cylinders shall not be used in buildings for temporary emergency heating purposes except when all of the following conditions are met:

(1) The permanent heating system is temporarily out of service.
(2) Heat is necessary to prevent damage to the buildings or contents.
(3) The cylinders and heaters comply with, and are used and transported in accordance with, 6.20.2 through 6.20.4.
(4) The temporary heating equipment is not left unattended.
(5) Air for combustion and ventilation is provided in accordance with NFPA 54, *National Fuel Gas Code.*

6.20.8.2 When a public emergency has been declared and gas, fuel, or electrical service has been interrupted, portable listed LP-Gas commercial food service appliances meeting the requirements of 6.20.9.4 shall be permitted to be temporarily used inside affected buildings.

6.20.8.3 The portable appliances used shall be discontinued and removed from the building at the time the permanently installed appliances are placed back in operation.

6.20.9 Use in Buildings for Demonstrations or Training, and Use of Small Cylinders for Self-Contained Torch Assemblies and Food Service Appliances.

6.20.9.1 Cylinders used temporarily inside buildings for public exhibitions or demonstrations, including use in classroom demonstrations, shall be in accordance with the following:

(1) The maximum water capacity of a cylinder shall be 12 lb (5.4 kg) [nominal 5 lb (2 kg) propane capacity].
(2) If more than one such cylinder is located in a room, the cylinders shall be separated by at least 20 ft (6.1 m).

6.20.9.2 Cylinders used temporarily in buildings for training purposes related to the installation and use of LP-Gas systems shall be in accordance with the following:

(1) The maximum water capacity of individual cylinders shall be 245 lb (111 kg) [nominal 100 lb (45 kg) propane capacity], but not more than 20 lb (9.1 kg) of propane shall be placed in a single cylinder.
(2) If more than one such cylinder is located in the same room, the cylinders shall be separated by at least 20 ft (6.1 m).
(3) The training location shall be acceptable to the authority having jurisdiction.
(4) Cylinders shall be promptly removed from the building when the training class has terminated.

6.20.9.3* Cylinders used in buildings as part of approved self-contained torch assemblies or similar appliances shall be in accordance with the following:

(1) Cylinders used in buildings shall comply with ANSI/UL 147A, *Standard for Nonrefillable (Disposable) Type Fuel Gas Cylinder Assemblies.*
(2) Cylinders shall have a maximum water capacity of 2.7 lb (1.2 kg).

6.20.9.4 Cylinders used with commercial food service appliances shall be used inside restaurants and in attended commercial food catering operations in accordance with the following:

(1) Cylinders and appliances shall be listed.
(2) Commercial food service appliances shall not have more than two 10 oz (296 ml) nonrefillable butane gas cylinders, each having a maximum capacity of 1.08 lb (0.490 kg).
(3) Cylinders shall comply with ANSI/UL 147B, *Standard for Nonrefillable (Disposable) Type Metal Container Assemblies for Butane.*
(4) Cylinders shall be connected directly to the appliance and shall not be manifolded.
(5) Cylinders shall be an integral part of the listed, approved, commercial food service device and shall be connected without the use of a rubber hose.
(6) Storage of cylinders shall be in accordance with 8.3.1.

6.20.10 Use in Building for Flame Effects Before a Proximate Audience.

6.20.10.1 Where cylinders are used temporarily in buildings for flame effects before an audience, the flame effect shall be in accordance with NFPA 160, *Standard for the Use of Flame Effects Before an Audience.*

6.20.10.2 The maximum water capacity of individual cylinders shall be 48 lb (22 kg) [nominal 20 lb (9.1 kg) propane capacity].

6.20.10.3* If more than one cylinder is located in the same room, the cylinders shall be separated by at least 20 ft (6.1 m).

6.20.10.4 Where a separation of 20 ft (6.1 m) is not practical, reduction of distances shall be permitted with the approval of the authority having jurisdiction.

6.20.10.5 Cylinders shall not be connected or disconnected during the flame effect or performance.

6.20.11 Cylinders on Roofs or Exterior Balconies.

6.20.11.1 Where cylinders are installed permanently on roofs of buildings, the buildings shall be of fire-resistant construction

or noncombustible construction having essentially noncombustible contents, or of other construction or contents that are protected with automatic sprinklers.

(A) The total water capacity of cylinders connected to any one manifold shall be not greater than 980 lb (445 kg) [nominal 400 lb (181 kg) propane capacity]. If more than one manifold is located on the roof, it shall be separated from any other by at least 50 ft (15 m).

(B) Cylinders shall be located in areas where there is free air circulation, at least 10 ft (3 m) from building openings (such as windows and doors), and at least 20 ft (6.1 m) from air intakes of air-conditioning and ventilating systems.

(C) Cylinders shall not be located on roofs that are entirely enclosed by parapets more than 18 in. (460 mm) high unless the parapets are breached with low-level ventilation openings not more than 20 ft (6.1 m) apart, or unless all openings communicating with the interior of the building are at or above the top of the parapets.

(D) Piping shall be in accordance with 6.20.2.3 through 6.20.2.5.

(E) Hose shall not be used for connection to cylinders.

(F) The fire department shall be advised of each installation.

6.20.11.2 Cylinders having water capacities greater than 2.7 lb (1 kg) [nominal 1 lb (0.5 kg) LP-Gas capacity] shall not be located on decks or balconies of dwellings of two or more living units above the first floor unless they are served by exterior stairways.

6.20.12 Liquid LP-Gas Piped into Buildings or Structures.

6.20.12.1 Buildings or separate areas of buildings into which LP-Gas liquid at pressures exceeding 20 psig (138 kPag) is piped shall be constructed in accordance with Chapter 10 and shall be used for the purposes listed in 6.9.1.1(D)(2).

6.20.12.2 Liquid LP-Gas piped into buildings under construction or major renovation in accordance with 6.9.1.1(D)(1) shall comply with 6.20.12.2(A) through 6.20.12.2(J).

(A) Liquid piping shall not exceed ¾ in. (20 mm) and shall comply with 6.9.1 and 6.9.3.

(B) Copper tubing with a maximum outside diameter of ¾ in. (20 mm) shall be used where approved by the authority having jurisdiction.

(C) Liquid piping in buildings shall be kept to a minimum length and shall be protected against construction hazards by fastening it to walls or other surfaces to provide protection against breakage and by locating it so as to avoid exposure to high ambient temperatures.

(D) A readily accessible shutoff valve shall be located at each intermediate branch line where it leaves the main line.

(E) A second shutoff valve shall be located at the appliance end of the branch and upstream of any flexible appliance connector.

(F) Excess-flow valves shall be installed downstream of each branch line shutoff valve.

(G) Excess-flow valves shall be located at any point in the piping system where branch lines are used and the pipe size of the branch line is reduced. The excess flow valve shall be sized for the reduced size of the branch line piping.

(H) Hose shall not be used to carry liquid between the container and building and shall not be used at any point in the liquid line.

(I) Hydrostatic relief valves shall be installed where required.

(J) The release of fuel when any section of piping or appliances is disconnected shall be minimized either by using an approved automatic quick-closing coupling that shuts off the gas on both sides when uncoupled or by closing the shutoff valve closest to the point to be disconnected and allowing the appliances on that line to operate until the fuel in the line is consumed.

6.21 Installation of Appliances.

6.21.1 Application.

6.21.1.1 Section 6.21 shall apply to the installation of LP-Gas appliances.

6.21.1.2 Installation of appliances on commercial vehicles shall be in accordance with 6.24.7.

6.21.2 Installation of Patio Heaters.

6.21.2.1 Patio heaters utilizing an integral LP-Gas container greater than 1.08 lb (0.49 kg) propane capacity shall comply with 6.21.2.2 and 6.21.2.3.

6.21.2.2 Patio heaters shall be listed and used in accordance with their listing and the manufacturer's instructions.

6.21.2.3 Patio heaters shall not be located within 5 ft (1.5 m) of exits from an assembly occupancy.

6.21.3 Hose for Portable Appliances.

6.21.3.1 The requirements of Section 6.21 shall apply to hoses used on the low-pressure side of regulators to connect portable appliances.

6.21.3.2 Where used inside buildings, the following shall apply:

(1) The hose shall be the minimum practical length and shall be in accordance with 6.20.2.5.
(2) The hose shall not extend from one room to another or pass through any partitions, walls, ceilings, or floors except as provided by 6.20.4.9.
(3) The hose shall not be concealed from view or used in concealed locations.

6.21.3.3 Where installed outside of buildings, the hose length shall be permitted to exceed 10 ft (3 m) but shall be as short as practical.

6.21.3.4 Hose shall be securely connected to the appliance.

6.21.3.5 The use of rubber slip ends shall not be permitted.

6.21.3.6 A shutoff valve shall be provided in the piping immediately upstream of the inlet connection of the hose.

6.21.3.7 Where more than one such appliance shutoff is located near another, the valves shall be marked to indicate which appliance is connected to each valve.

6.21.3.8 Hose shall be protected against physical damage.

6.22 Vaporizer Installation.

6.22.1 Nonapplication. Section 6.22 shall not apply to engine fuel vaporizers or to integral vaporizing burners such as those used for weed burners or tar kettles.

6.22.2 Installation of Indirect-Fired Vaporizers.

6.22.2.1 Indirect-fired vaporizers shall be installed outdoors, or in separate buildings or structures that comply with Section 10.2, or in attached structures or rooms that comply with Section 10.3.

6.22.2.2 The separate building or structure shall not have any unprotected drains to sewers or sump pits.

6.22.2.3 Pressure relief valves on vaporizers within buildings in industrial or gas manufacturing plants shall be piped to a point outside the building or structure and shall discharge vertically upward.

6.22.2.4 If the heat source of an indirect-fired vaporizer is gas fired and is located within 15 ft (4.6 m) of the vaporizer, the vaporizer and its heat source shall be installed as a direct-fired vaporizer and shall be subject to the requirements of 6.22.3.

6.22.2.5 The installation of a heat source serving an indirect-fired vaporizer that utilizes a flammable or combustible heat transfer fluid shall comply with one of the following:

(1) It shall be located outdoors.
(2) It shall be located within a structure that complies with Section 10.2.
(3) It shall be located within a structure attached to, or in rooms within, a building or structure that complies with Section 10.3.

6.22.2.6 Gas-fired heating systems supplying heat for vaporization purposes shall be equipped with automatic safety devices to shut off gas to the main burners if ignition fails to occur.

6.22.2.7 The installation of a heat source serving an indirect-fired vaporizer that utilizes a noncombustible heat transfer fluid, such as steam, water, or a water-glycol mixture, shall be installed outdoors or in industrial occupancies.

6.22.2.8 Industrial occupancies in which a source of heat for an indirect-fired vaporizer is installed shall comply with Chapter 40 of NFPA *101*, *Life Safety Code*, and Section 10.3 of NFPA 54, *National Fuel Gas Code* (ANSI Z223.1).

6.22.2.9 The following shall apply to indirect-fired vaporizers installed in buildings:

(1) The heat transfer fluid shall be steam or hot water.
(2) The heat transfer fluid shall not be recirculated.
(3) A backflow preventer shall be installed between the vaporizer and the heat source.

6.22.2.10 If the heat transfer fluid is recirculated after leaving the vaporizer, the heat source shall be installed in accordance with 6.22.2.5 and a phase separator shall be installed with the gas vented.

6.22.2.11 Indirect-fired vaporizers employing heat from the atmosphere shall be installed outdoors and shall be located in accordance with Table 6.22.3.6.

6.22.2.12 Where atmospheric vaporizers of less than 1 qt (0.9 L) capacity are installed in industrial occupancies, they shall be installed as close as practical to the point of entry of the supply line in the building.

6.22.2.13 Atmospheric vaporizers of less than 1 qt (0.9 L) capacity shall not be installed in other than industrial occupancies.

6.22.3 Installation of Direct-Fired Vaporizers.

6.22.3.1 Where a direct-fired vaporizer is installed in a separate structure, the separate structure shall be constructed in accordance with Chapter 10.

6.22.3.2 The housing for direct-fired vaporizers shall not have any drains to a sewer or a sump pit that is shared with any other structure.

6.22.3.3 Pressure relief valve discharges on direct-fired vaporizers shall be piped to a point outside the structure or building.

6.22.3.4 Direct-fired vaporizers shall be connected to the liquid space or to the liquid and vapor space of the ASME container.

6.22.3.5 A manually operated shutoff valve shall be installed in each connection of the ASME container supplying the vaporizer.

6.22.3.6 Direct-fired vaporizers of any capacity shall be located in accordance with Table 6.22.3.6.

Table 6.22.3.6 Minimum Separation Distances Between Direct-Fired Vaporizers and Exposures

Exposure	Minimum Distance Required	
	ft	m
Container	10	3.0
Container shutoff valves	15	4.6
Point of transfer	15	4.6
Nearest important building or group of buildings or line of adjoining property that can be built upon	25	7.6
Nearest Chapter 10 building or room housing gas–air mixer	10	3.0
Cabinet housing gas–air mixer outdoors	0	0

Note: Do not apply distances to the building in which a direct-fired vaporizer is installed.

6.22.4 Installation of Tank Heaters.

6.22.4.1 Direct-type tank heaters shall be installed only on aboveground ASME containers.

6.22.4.2 Direct gas-fired tank heaters shall only be installed on steel containers.

6.22.4.3 Tank heaters containing sources of ignition, together with the container upon which they are installed, shall be located in accordance with Table 6.22.4.3 with respect to the nearest important building, group of buildings, or line of adjoining property that can be built upon.

6.22.4.4 If the tank heater is similar in operation to an indirect-fired vaporizer, the heat source shall comply with 6.22.2.8 and 6.22.2.11.

6.22.4.5 If a point of transfer is located within 15 ft (4.6 m) of a tank heater having a source of ignition, the source of ignition shall be shut off during product transfer and a caution notice in letters ¾ in. (19 mm) high or larger that reads as follows shall be displayed immediately adjacent to the filling connections:

Table 6.22.4.3 Minimum Separation Between Tank Heaters and Exposures

Container Water Capacity		Minimum Distance Required	
gal	m^3	ft	m
≤500	≤1.9	10	3.0
501–2,000	>1.9–7.6	25	7.6
2,001–30,000	>7.6–114	50	15.0
30,001–70,000	>114–265	75	23.0
70,001–90,000	>265–341	100	30.5
90,001–120,000	>341–454	125	38.1

CAUTION: A device that contains a source of ignition is connected to this container. The source of ignition must be shut off before filling the container.

6.22.4.6* Annual Inspection.

(A) Direct-type tank heaters shall be removed annually and the container surface shall be inspected.

(B) If corrosion or coating damage other than discoloration is found, the container shall be removed from service and tested in accordance with 5.2.1.2(B).

6.22.5 Installation of Vaporizing Burners.

6.22.5.1 Vaporizing burners shall be installed outside of buildings.

6.22.5.2 The minimum distance between any container and a vaporizing burner shall be in accordance with Table 6.22.5.2.

Table 6.22.5.2 Minimum Separation Distance Between Containers and Vaporizing Burners

Container Water Capacity		Minimum Distance Required	
gal	m^3	ft	m
≤500	≤1.9	10	3.0
501–2000	1.9–7.6	25	7.6
>2000	>7.6	50	15.0

6.22.5.3 Manually operated positive shutoff valves shall be located at the containers to shut off all flow to the vaporizing burners.

6.22.6 Installation of Waterbath Vaporizers.

6.22.6.1 If a waterbath vaporizer is electrically heated and all electrical equipment is designed for Class I, Group D locations, the unit shall be treated as an indirect-fired vaporizer and shall be installed in accordance with 6.22.2.

6.22.6.2 All other waterbath vaporizers shall be treated as direct-fired vaporizers and shall be installed in accordance with 6.22.3.

6.22.7 Installation of Electric Vaporizers. Electric vaporizers, whether direct immersion or indirect immersion, shall be treated as indirect-fired and shall be installed in accordance with 6.22.2.

6.22.8 Installation of Gas–Air Mixers.

6.22.8.1 Piping and equipment installed with a gas–air mixer shall comply with 6.9.1, 6.9.3, and Section 6.14.

6.22.8.2 Where used without a vaporizer, a mixer shall be installed outdoors or in a building complying with Chapter 10.

6.22.8.3 Where used with an indirect-fired vaporizer, a mixer shall be installed as follows:

(1) In an outdoor location
(2) In the same compartment or room with the vaporizer
(3) In a building complying with Chapter 10
(4) In a location that is both remote from the vaporizer and in accordance with 6.22.2

6.22.8.4 Where used with a direct-fired vaporizer, a mixer shall be installed as follows:

(1) With a listed or approved mixer in a common cabinet with the vaporizer outdoors in accordance with 6.22.3.6
(2) Outdoors on a common skid with the vaporizer in accordance with 6.22.3
(3) Adjacent to the vaporizer to which it is connected in accordance with 6.22.3
(4) In a building complying with Chapter 10 without a direct-fired vaporizer in the same room

6.23 Ignition Source Control.

6.23.1 Scope.

6.23.1.1 This section shall apply to the minimization of ignition of flammable LP-Gas–air mixtures resulting from the normal or accidental release of nominal quantities of liquid or vapor from LP-Gas systems installed and operated in accordance with this code.

6.23.1.2* The installation of lightning protection equipment shall not be required on LP-Gas storage containers.

6.23.1.3* Grounding and bonding shall not be required on LP-Gas systems.

6.23.2 Electrical Equipment.

6.23.2.1 Electrical equipment and wiring installed in unclassified areas shall be in accordance with *NFPA 70, National Electrical Code.*

6.23.2.2* The extent of electrically classified areas shall be in accordance with Table 6.23.2.2.

6.23.2.3* The provisions of 6.23.2.2 shall apply to vehicular fuel operations.

6.23.2.4 The provisions of 6.23.2.2 shall not apply to fixed electrical equipment at residential or commercial installations of LP-Gas systems or to systems covered by Section 6.24.

6.23.2.5 Fired vaporizers, calorimeters with open flames, and other areas where open flames are present either intermittently or constantly shall not be considered electrically classified areas.

6.23.2.6 Electrical equipment installed on LP-Gas cargo tank vehicles shall comply with Section 9.2.

6.23.3 Other Sources of Ignition.

6.23.3.1 Open flames or other sources of ignition shall not be used or installed in pump houses, cylinder filling rooms, or other similar locations.

Table 6.23.2.2 Electrical Area Classification

Part	Location	Extent of Classified Area[a]	Equipment Shall Be Approved for Compliance with NFPA 70, *National Electrical Code*, Class I[a], Group D[b]
A	Unrefrigerated containers other than cylinders and ASME vertical containers of less than 1000 lb (454 kg) water capacity	Within 15 ft (4.6 m) in all directions from connections, except connections otherwise covered in this table	Division 2
B	Refrigerated storage containers	Within 15 ft (4.6 m) in all directions from connections otherwise covered in this table	Division 2
		Area inside dike to the level of the top of the dike	Division 2
C[c]	Tank vehicle and tank car loading and unloading	Within 5 ft (1.5 m) in all directions from connections regularly made or disconnected for product transfer	Division 1
		Beyond 5 ft (1.5 m) but within 15 ft (4.6 m) in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade	Division 2
D	Gauge vent openings other than those on cylinders and ASME vertical containers of less than 1000 lb (454 kg) water capacity	Within 5 ft (1.5 m) in all directions from point of discharge	Division 1
		Beyond 5 ft (1.5 m) but within 15 ft (4.6 m) in all directions from point of discharge	Division 2
E	Relief device discharge other than those on cylinders and ASME vertical containers of less than 1000 lb (454 kg) water capacity and vaporizers	Within direct path of discharge	Fixed electrical equipment not permitted to be installed
F[c]	Pumps, vapor compressors, gas–air mixers and vaporizers (other than direct-fired or indirect-fired with an attached or adjacent gas-fired heat source)		
	Indoors without ventilation	Entire room and any adjacent room not separated by a gastight partition	Division 1
		Within 15 ft (4.6 m) of the exterior side of any exterior wall or roof that is not vaportight or within 15 ft (4.6 m) of any exterior opening	Division 2
	Indoors with ventilation	Entire room and any adjacent room not separated by a gastight partition	Division 2
	Outdoors in open air at or above grade	Within 15 ft (4.6 m) in all directions from this equipment and within the cylindrical volume between the horizontal equator of the sphere and grade	Division 2
G	Vehicle fuel dispenser	Entire space within dispenser enclosure, and 18 in. (460 mm) horizontally from enclosure exterior up to an elevation 4 ft (1.2 m) above dispenser base; entire pit or open space beneath dispenser	Division 1
		Up to 18 in. (460 mm) above ground within 20 ft (6.1 m) horizontally from any edge of enclosure (Note: For pits within this area, see part H of this table.)	Division 2

Table 6.23.2.2 Continued

Part	Location	Extent of Classified Area[a]	Equipment Shall Be Approved for Compliance with NFPA 70, *National Electrical Code*, Class I[a], Group D[b]
H	Pits or trenches containing or located beneath LP-Gas valves, pumps, vapor compressors, regulators, and similar equipment		
	Without mechanical ventilation	Entire pit or trench	Division 1
		Entire room and any adjacent room not separated by a gastight partition	Division 2
		Within 15 ft (4.6 m) in all directions from pit or trench when located outdoors	Division 2
	With mechanical ventilation	Entire pit or trench	Division 2
		Entire room and any adjacent room not separated by a gastight partition	Division 2
		Within 15 ft (4.6 m) in all directions from pit or trench when located outdoors	Division 2
I	Special buildings or rooms for storage of cylinders	Entire room	Division 2
J	Pipelines and connections containing operational bleeds, drips, vents, or drains	Within 5 ft (1.5 m) in all directions from point of discharge	Division 1
		Beyond 5 ft (1.5 m) from point of discharge, same as part F of this table	
K[c]	Cylinder filling		
	Indoors with ventilation	Within 5 ft (1.5 m) in all directions from a point of transfer	Division 1
		Beyond 5 ft (1.5 m) and entire room	Division 2
	Outdoors in open air	Within 5 ft (1.5 m) in all directions from a point of transfer	Division 1
		Beyond 5 ft (1.5 m) but within 15 ft (4.6 m) in all directions from point of transfer and within the cylindrical volume between the horizontal equator of the sphere and grade	Division 2
L	Piers and wharves	Within 5 ft (1.5 m) in all directions from connections regularly made or disconnected for product transfer	Division 1
		Beyond 5 ft (1.5 m) but within 15 ft (4.6 m) in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and the vessel deck	Division 2

[a]The classified area is prohibited from extending beyond an unpierced wall, roof, or solid vaportight partition.
[b]See Article 500, Hazardous (Classified) Locations, in NFPA 70, *National Electrical Code*, for definitions of classes, groups, and divisions.
[c]See A.6.23.2.2.

6.23.3.2 Direct-fired vaporizers or indirect-fired vaporizers attached or installed adjacent to gas-fired heat sources shall not be installed in pump houses or cylinder filling rooms.

6.23.3.3 Open flames, cutting or welding tools, portable electric tools, and extension lights capable of igniting LP-Gas shall not be installed or used within classified areas specified in Table 6.23.2.2.

6.23.3.4 Open flames or other sources of ignition shall not be prohibited where containers, piping, and other equipment containing LP-Gas have been purged of all liquid and vapor LP-Gas.

6.24 LP-Gas Systems on Vehicles (Other Than Engine Fuel Systems).

6.24.1* Application. Section 6.24 shall apply to the following:

(1) Nonengine fuel systems on all vehicles
(2) Installations served by exchangeable (removable) cylinder systems and by permanently mounted containers

6.24.2 Nonapplication. Section 6.24 shall not apply to the following:

(1) Systems installed on mobile homes
(2) Systems installed on recreational vehicles
(3) Cargo tank vehicles, including trailers and semitrailers, and similar units used to transport LP-Gas as cargo, which are covered by Chapter 9
(4) LP-Gas engine fuel systems on the vehicles, which are covered by Chapter 11

6.24.3 Container Installation Requirements.

6.24.3.1 Containers shall comply with 6.24.3.1(A) through 6.24.3.1(D).

(A) ASME mobile containers shall be in accordance with one of the following:

(1) A MAWP of 312 psig (2.2 MPag) or higher where installed in enclosed spaces of vehicles
(2) A MAWP of 312 psig (2.2 MPag) or higher where installed on passenger vehicles
(3) A MAWP of 250 psig (1.7 MPag) or higher for containers where installed on the exterior of nonpassenger vehicles

(B) LP-Gas fuel containers used on passenger-carrying vehicles shall not exceed 200 gal (0.8 m^3) aggregate water capacity.

(C) The capacity of individual LP-Gas containers on highway vehicles shall be in accordance with Table 6.24.3.1(C).

Table 6.24.3.1(C) Maximum Capacities of Individual LP-Gas Containers Installed on LP-Gas Highway Vehicles

Vehicle	Maximum Container Water Capacity	
	gal	m^3
Passenger vehicle	200	0.8
Nonpassenger vehicle	300	1.1
Road surfacing vehicle	1000	3.8
Cargo tank vehicle	Not limited by this code	

(D) Containers designed for stationary service only and not in compliance with the container appurtenance protection requirements of 5.2.6 shall not be used.

6.24.3.2 ASME containers and cylinders utilized for the purposes covered by Section 6.24 shall not be installed, transported, or stored (even temporarily) inside any vehicle covered by Section 6.24, except for ASME containers installed in accordance with 6.24.3.4(I), Chapter 9, or DOT regulations.

6.24.3.3 The LP-Gas supply system, including the containers, shall be installed either on the outside of the vehicle or in a recess or cabinet vaportight to the inside of the vehicle but accessible from and vented to the outside, with the vents located near the top and bottom of the enclosure and 3 ft (1 m) horizontally away from any opening into the vehicle below the level of the vents.

6.24.3.4 Containers shall be mounted securely on the vehicle or within the enclosing recess or cabinet.

(A) Containers shall be installed with road clearance in accordance with 11.8.3.

(B) Fuel containers shall be mounted to prevent jarring loose and slipping or rotating, and the fastenings shall be designed and constructed to withstand, without permanent visible deformation, static loading in any direction equal to four times the weight of the container filled with fuel.

(C) Where containers are mounted within a vehicle housing, the securing of the housing to the vehicle shall comply with this provision. Any removable portions of the housing or cabinet shall be secured while in transit.

(D) Field welding on containers shall be limited to attachments to nonpressure parts such as saddle plates, wear plates, or brackets applied by the container manufacturer.

(E) All container valves, appurtenances, and connections shall be protected to prevent damage from accidental contact with stationary objects; from loose objects, stones, mud, or ice thrown up from the ground or floor; and from damage due to overturn or similar vehicular accident.

(F) Permanently mounted ASME containers shall be located on the vehicle to provide the protection specified in 6.24.3.4(E).

(G) Cylinders shall have permanent protection for cylinder valves and connections.

(H) Where cylinders are located on the outside of a vehicle, weather protection shall be provided.

(I) Containers mounted on the interior of passenger-carrying vehicles shall be installed in compliance with Section 11.9. Pressure relief valve installations for such containers shall comply with 11.8.5.

6.24.3.5 Cylinders installed on portable tar kettles alongside the kettle, on the vehicle frame, or on road surface heating equipment shall be protected from radiant or convected heat from open flame or other burners by the use of a heat shield or by the location of the cylinder(s) on the vehicle. In addition, the following shall apply:

(1) Cylinder valves shall be closed when burners are not in use.
(2) Cylinders shall not be refilled while burners are in use as provided in 7.2.3.2(B).

6.24.4 Installation of Container Appurtenances.

6.24.4.1 Container appurtenances shall be installed in accordance with the following:

(1) Pressure relief valve installation on ASME containers installed in the interior of vehicles complying with Section 11.9 shall comply with 11.8.5.
(2) Pressure relief valve installations on ASME containers installed on the outside of vehicles shall comply with 11.8.5 and 6.24.3.3.
(3) Main shutoff valves on containers for liquid and vapor shall be readily accessible.
(4) Cylinders shall be designed to be filled in either the vertical or horizontal position, or if they are the universal type, they are permitted to be filled in either position.
(5) All container inlets, outlets, or valves installed in container inlets or outlets, except pressure relief devices and gauging devices, shall be labeled to designate whether they communicate with the vapor or liquid space.
(6) Containers from which only vapor is to be withdrawn shall be installed and equipped with connections to minimize the possibility of the accidental withdrawal of liquid.

6.24.4.2 Regulators shall be installed in accordance with 6.8.2 and 6.24.4.2(A) through 6.24.4.2(E).

(A) Regulators shall be installed with the pressure relief vent opening pointing vertically downward to allow for drainage of moisture collected on the diaphragm of the regulator.

(B) Regulators not installed in compartments shall be equipped with a durable cover designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray.

(C) If vehicle-mounted regulators are installed at or below the floor level, they shall be installed in a compartment that provides protection against the weather and wheel spray.

(D) Regulator compartments shall comply with the following:

(1) The compartment shall be of sufficient size to allow tool operation for connection to and replacement of the regulator(s).
(2) The compartment shall be vaportight to the interior of the vehicle.
(3) The compartment shall have a 1 in.^{2} (650 mm^2) minimum vent opening to the exterior located within 1 in. (25 mm) of the bottom of the compartment.
(4) The compartment shall not contain flame or spark-producing equipment.

(E) A regulator vent outlet shall be at least 2 in. (51 mm) above the compartment vent opening.

6.24.5 Piping.

6.24.5.1 Piping shall be installed in accordance with 6.9.3 and 6.24.5.1(A) through 6.24.5.1(M).

(A) Steel tubing shall have a minimum wall thickness of 0.049 in. (1.2 mm).

(B) A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains.

(C) Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator.

(D) Flexible connectors shall be installed in accordance with 6.9.6.

(E) Flexible connectors longer than the length allowed in the code, or fuel lines that incorporate hose, shall be used only where approved.

(F) The fixed piping system shall be designed, installed, supported, and secured to minimize the possibility of damage due to vibration, strains, or wear and to preclude any loosening while in transit.

(G) Piping shall be installed in a protected location.

(H) Where piping is installed outside the vehicle, it shall be installed as follows:

(1) Piping shall be under the vehicle and below any insulation or false bottom.
(2) Fastening or other protection shall be installed to prevent damage due to vibration or abrasion.
(3) At each point where piping passes through sheet metal or a structural member, a rubber grommet or equivalent protection shall be installed to prevent chafing.

(I) Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served.

(J) If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle.

(K) Exposed parts of the fixed piping system either shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion.

(L) Hydrostatic relief valves shall be installed in isolated sections of liquid piping as provided in Section 6.13.

(M) Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.14.

6.24.5.2 There shall be no fuel connection between a tractor and trailer or other vehicle units.

6.24.6 Equipment Installation. Equipment shall be installed in accordance with Section 6.18, 6.24.6.1, and 6.24.6.2.

6.24.6.1 Installation shall be made in accordance with the manufacturer's recommendations and, in the case of approved equipment, as provided in the approval.

6.24.6.2 Equipment installed on vehicles shall be protected against vehicular damage as provided for container appurtenances and connections in 6.24.3.4(E).

6.24.7 Appliance Installation on Vehicles.

6.24.7.1 Subsection 6.24.7 shall apply to the installation of all appliances on vehicles. It shall not apply to engines.

6.24.7.2 All appliances covered by 6.24.7 installed on vehicles shall be approved.

6.24.7.3 Where the device or appliance, such as a cargo heater or cooler, is designed to be in operation while the vehicle is in transit, means, such as an excess-flow valve, to stop the flow of gas in the event of a line break shall be installed.

6.24.7.4 Gas-fired heating appliances shall be equipped with shutoffs in accordance with 5.20.7(A), except for portable heaters used with cylinders having a maximum water capacity of 2.7 lb (1.2 kg), portable torches, melting pots, and tar kettles.

6.24.7.5 Gas-fired heating appliances, other than ranges and illuminating appliances installed on vehicles intended for human occupancy, shall be designed or installed to provide for a

complete separation of the combustion system from the atmosphere inside the vehicle.

6.24.7.6* Where unvented-type heaters that are designed to protect cargo are used on vehicles not intended for human occupancy, provisions shall be made to provide air from the outside for combustion and dispose of the products of combustion to the outside.

6.24.7.7 Appliances installed in the cargo space of a vehicle shall be readily accessible whether the vehicle is loaded or empty.

6.24.7.8 Appliances shall be constructed or otherwise protected to minimize possible damage or impaired operation due to cargo shifting or handling.

6.24.7.9 Appliances shall be located so that a fire at any appliance will not block egress of persons from the vehicle.

6.24.7.10 A permanent caution plate shall be affixed to either the appliance or the vehicle outside of any enclosure, shall be adjacent to the container(s), and shall include the following instructions:

CAUTION:
(1) Be sure all appliance valves are closed before opening container valve.
(2) Connections at the appliances, regulators, and containers shall be checked periodically for leaks with soapy water or its equivalent.
(3) Never use a match or flame to check for leaks.
(4) Container valves shall be closed when equipment is not in use.

6.24.7.11 Gas-fired heating appliances and water heaters shall be equipped with automatic devices designed to shut off the flow of gas to the main burner and the pilot in the event the pilot flame is extinguished.

6.24.8 General Precautions.

6.24.8.1 Mobile units including mobile kitchens and catering vehicles that contain hot plates and other cooking equipment shall be provided with at least one approved portable fire extinguisher rated in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, at not less than 10-B:C.

6.24.8.2 Where fire extinguishers have more than one letter classification, they shall be considered as meeting the requirements of each letter class.

6.24.9 Parking, Servicing, and Repair.

6.24.9.1 Where vehicles with LP-Gas fuel systems used for purposes other than propulsion are parked, serviced, or repaired inside buildings, the requirements of 6.24.9.2 through 6.24.9.4 shall apply.

6.24.9.2 The fuel system shall be leak-free, and the container(s) shall not be filled beyond the limits specified in Chapter 7.

6.24.9.3 The container shutoff valve shall be closed, except that the container shutoff valve shall not be required to be closed when fuel is required for test or repair.

6.24.9.4 The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition, or near unventilated pits.

6.24.9.5 Vehicles having containers with water capacities larger than 300 gal (1.1 m^3) shall comply with the requirements of Section 9.7.

6.25 Vehicle Fuel Dispenser and Dispensing Stations.

6.25.1 Application.

6.25.1.1 Section 6.25 includes the location, installation, and operation of vehicle fuel dispensers and dispensing stations.

6.25.1.2 The provisions of Sections 6.2 and 6.3, as modified by Section 6.25, shall apply.

6.25.2 Location.

6.25.2.1 Location of vehicle fuel dispensers and dispensing stations shall be in accordance with Table 6.5.2.1.

6.25.2.2 Vehicle fuel dispensers and dispensing stations shall be located away from pits in accordance with Table 6.5.2.1, with no drains or blow-offs from the unit directed toward or within 15 ft (4.6 m) of a sewer system's opening.

6.25.3 General Installation Provisions.

6.25.3.1 Vehicle fuel dispensers and dispensing stations shall be installed in accordance with the manufacturer's installation instructions.

6.25.3.2 Vehicle fuel dispensers and dispensing stations shall not be located within an enclosed building or structure, unless they comply with Chapter 10.

6.25.3.3 Where a vehicle fuel dispenser is installed under a weather shelter or canopy, the area shall be ventilated and shall not be enclosed for more than 50 percent of its perimeter.

6.25.3.4 Control for the pump used to transfer LP-Gas through the unit into containers shall be provided at the device in order to minimize the possibility of leakage or accidental discharge.

6.25.3.5 An excess-flow check valve or a differential back pressure valve shall be installed in or on the dispenser at the point at which the dispenser hose is connected to the liquid piping.

6.25.3.6 Piping and the dispensing hose shall be provided with hydrostatic relief valves in accordance with Section 6.13.

6.25.3.7 Protection against trespassing and tampering shall be in accordance with 6.19.4.

6.25.3.8 The container liquid withdrawal opening used with vehicle fuel dispensers and dispensing stations shall be equipped with one of the following:

(1) An internal valve fitted for remote closure and automatic shutoff using thermal (fire) actuation
(2) A positive shutoff valve that is located as close to the container as practical in combination with an excess-flow valve installed in the container, plus an emergency shutoff valve that is fitted for remote closure and installed downstream in the line as close as practical to the positive shutoff valve

6.25.3.9 An identified and accessible remote emergency shutoff device for either the internal valve or the emergency shutoff valve required by 6.25.3.8(1) or (2) shall be installed not less than 3 ft (1 m) or more than 100 ft (30 m) from the liquid transfer point.

6.25.3.10 Emergency shutoff valves and internal valves that are fitted for remote closure as required in this section shall be tested annually for proper operation.

6.25.3.11 A manual shutoff valve and an excess-flow check valve shall be located in the liquid line between the pump and the dispenser inlet where the dispensing device is installed at a remote location and is not part of a complete storage and dispensing unit mounted on a common base.

6.25.3.12 All dispensers shall be installed on a concrete foundation or shall be part of a complete storage and dispensing unit mounted on a common base and installed in accordance with 6.6.3.1(G).

6.25.3.13 Vehicular barrier protection (VBP) shall be provided for containers serving liquid dispensers where those containers are located within 10 ft (3 m) of a vehicle thoroughfare or parking location in accordance with 6.25.3.13(A) or 6.25.3.13(B).

(A) Concrete filled guard posts shall be constructed of steel not less than 4 in. (100 mm) in diameter with the following characteristics:

(1) Spaced not more than 4 ft (1200 mm) between posts on center
(2) Set not less than 3 ft (900 mm) deep in a concrete footing of not less than 15 in. (380 mm) diameter
(3) Set with the top of the posts not less than 3 ft (900 mm) above ground
(4) Located not less than 3 ft (900 mm) from the protected installation

(B) Equivalent protection in lieu of guard posts shall be a minimum of 3 ft (900 mm) in height and shall resist a force of 12,000 lb (53,375 N) applied 3 ft (900 mm) above the adjacent ground surface.

6.25.3.14 Where the dispenser is not mounted on a common base with its storage container and the dispensing unit is located within 10 ft (3 m) of a vehicle thoroughfare, parking location, or an engine fuel filling station, the dispenser shall be provided with VBP.

6.25.3.15 Dispensers shall be protected from physical damage.

6.25.3.16 A listed quick-acting shutoff valve shall be installed at the discharge end of the transfer hose.

6.25.3.17 An identified and readily accessible switch or circuit breaker shall be installed outside at a location not less than 20 ft (6 m) or more than 100 ft (30 m) from the dispensing device(s) to shut off the power in the event of a fire, an accident, or other emergency.

6.25.3.18 The markings for the switches or breakers shall be visible at the point of liquid transfer.

6.25.4 Installation of Vehicle Fuel Dispensers.

6.25.4.1 Hose shall comply with the following:

(1) Hose length shall not exceed 18 ft (5.5 m) unless approved by the authority having jurisdiction.
(2) All hose shall be listed.
(3) When not in use, the hose shall be secured to protect the hose from damage.

6.25.4.2 A listed emergency breakaway device shall be installed and shall comply with ANSI/UL 567, *Standard for Emergency Breakaway Fittings, Swivel Connectors, and Pipe-Connection Fittings for Petroleum Products and LP-Gas,* and be designed to retain liquid on both sides of the breakaway point, or other devices affording equivalent protection approved by the authority having jurisdiction.

6.25.4.3 Dispensing devices for LP-Gas shall be located as follows:

(1) Conventional systems shall be at least 10 ft (3.0 m) from any dispensing device for Class I liquids.
(2) Low-emission transfer systems in accordance with 6.28.5 shall be at least 5 ft (2 m) from any dispensing device for Class I liquids.

New Section 6.26 was formerly Paragraph 11.15.2, relocated by a tentative interim amendment (TIA). See page 1.

6.26 Containers for Stationary Engines.

6.26.1 LP-Gas containers for stationary installations shall be located outside of buildings unless the buildings comply with the requirements of Chapter 10.

6.26.2 Containers for stationary engines shall be installed to meet the separation requirements of Section 6.3.

6.26.3 Where containers for stationary engines have a fill valve with an integral manual shutoff valve, the minimum separation distances shall be one-half of the distances specified in Section 6.3.

6.27 Fire Protection.

6.27.1 Application. Section 6.27 applies to fire protection for industrial plants, bulk plants, and dispensing stations.

6.27.2* Planning.

6.27.2.1 The planning for the response to incidents including the inadvertent release of LP-Gas, fire, or security breach shall be coordinated with local emergency response agencies.

6.27.2.2 Planning shall include consideration of the safety of emergency personnel, workers, and the public.

6.27.3* Protection of ASME Containers.

6.27.3.1* Fire protection shall be provided for installations with an aggregate water capacity of more than 4000 gal (15.2 m^3) and for ASME containers on roofs.

6.27.3.2 The modes of fire protection shall be specified in a written fire safety analysis for new installations, for existing installations that have an aggregate water capacity of more than 4000 gal (15.2 m^3), and for ASME containers on roofs. Existing installation shall comply with this requirement within 2 years of the effective date of this code.

6.27.3.3 The fire safety analysis shall be submitted by the owner, operator, or their designee to the authority having jurisdiction and local emergency responders.

6.27.3.4 The fire safety analysis shall be updated when the storage capacity or transfer system is modified.

6.27.3.5 The fire safety analysis shall be an evaluation of the total product control system, such as the emergency shutoff and internal valves equipped for remote closure and automatic shutoff using thermal (fire) actuation, pullaway protection where installed, and the optional requirements of Section 6.28.

6.27.3.6 If in the preparation for the fire safety analysis it is determined that a hazard to adjacent structures exists that exceeds the protection provided by the provisions of this code, special protection shall be provided in accordance with 6.27.5.

6.27.4 Other Protection Requirements.

6.27.4.1 Roadways or other means of access for emergency equipment, such as fire department apparatus, shall be provided.

6.27.4.2 Each industrial plant, bulk plant, and distributing point shall be provided with at least one approved portable fire extinguisher having a minimum capacity of 18 lb (8.2 kg) of dry chemical with a B:C rating.

6.27.4.3 Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

6.27.4.4* LP-Gas fires shall not be extinguished until the source of the burning gas has been shut off.

6.27.4.5 Emergency controls shall be conspicuously marked, and the controls shall be located so as to be readily accessible in emergencies.

6.27.5 Special Protection.

6.27.5.1* If insulation is used, it shall be capable of limiting the container temperature to not over 800°F (430°C) for a minimum of 50 minutes as determined by test, with insulation applied to a steel plate and subjected to a test flame applied substantially over the area of the test plate.

6.27.5.2 The insulation system shall be inherently resistant to weathering and the action of hose streams.

6.27.5.3 If mounding is utilized, the provisions of 6.6.6.3 shall be required.

6.27.5.4 If burial is utilized, the provisions of 6.6.6.1 shall be required.

6.27.6 Water Spray Systems.

6.27.6.1 If water spray fixed systems and monitors are used, they shall comply with NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection.*

6.27.6.2 Where water spray fixed systems and monitors are used, they shall be automatically actuated by fire-responsive devices and shall also have a capability for manual actuation.

6.27.6.3 Where monitor nozzles are used, they shall be located and arranged so that all container surfaces that can be exposed to fire are wetted.

6.28 Alternate Provisions for Installation of ASME Containers.

6.28.1 Application. Section 6.28 shall apply to alternate provisions for the location and installation of ASME containers that incorporate the use of redundant fail-safe product control measures and low-emission transfer concepts for the purpose of enhancing safety and to mitigate distance and special protection requirements.

6.28.2 Spacing Requirements for Underground and Mounded ASME Containers.

6.28.2.1 Where all the provisions of Section 6.28 are complied with, the minimum distances from important buildings and the line of adjoining property that can be built upon to underground and mounded ASME containers of 2001 gal through 30,000 gal (7.6 m^3 through 114 m^3) water capacity shall be reduced to 10 ft (3 m).

6.28.2.2 Distances for all underground and mounded ASME containers shall be measured from the container surface.

6.28.2.3 No part of an underground or mounded ASME container shall be less than 10 ft (3 m) from a building or line of adjoining property that can be built upon.

6.28.3 ASME Container Appurtenances. The provisions in 6.28.3.1 through 6.28.3.5 shall be required for ASME containers of 2001 gal through 30,000 gal (7.6 m^3 through 114 m^3) water capacity referenced in Section 6.28.

6.28.3.1 All liquid withdrawal openings and all vapor withdrawal openings that are 1¼ in. (32 mm) or larger shall be equipped with an internal valve.

6.28.3.2 The internal valves shall remain closed except during periods of operation.

6.28.3.3 Internal valves shall be equipped for remote closure and automatic shutoff through thermal (fire) actuation.

6.28.3.4 A positive manual shutoff valve shall be installed as close as practical to each internal valve.

6.28.3.5 All liquid and vapor inlet openings shall be equipped in accordance with 6.28.3.1 through 6.28.3.4 or shall be equipped with a backflow check valve that is designed for the intended application and a positive manual shutoff valve installed as close as practical to the backflow check valve.

6.28.4 Redundant Fail-Safe Product Control.

6.28.4.1 At cargo tank vehicle and railroad tank car transfer points, protection shall be provided in accordance with Section 6.12 using approved emergency shutoff valves or backflow check valves or a combination of the two.

6.28.4.2 Automatic system shutdown of all primary valves (internal valves and emergency shutoff valves) shall be provided through thermal (fire) actuation and in the event of a hose pull-away.

6.28.4.3 Remote shutdown capability, including power supply for the transfer equipment and all primary valves (internal and emergency shutoff), shall be provided.

(A) A remote shutdown station shall be installed within 15 ft (4.6 m) of the point of transfer.

(B) At least one additional remote shutdown station shall be installed not less than 25 ft (7.6 m), or more than 100 ft (30 m), from the transfer point.

(C) Emergency remote shutdown stations shall be identified as such by a sign incorporating the words "Propane" and "Emergency Shutoff" in block letters not less than 2 in. (51 mm) in height on a background of contrasting color to the letters. The sign shall be visible from the point of transfer.

6.28.5 Low Emission Transfer.

6.28.5.1 The transfer distance requirements of Table 6.5.2.1 and 6.25.4.3(1) shall be reduced by one-half where the installation is in accordance with 6.28.5.

6.28.5.2 The transfer site shall be identified as "Low Emission Transfer Site" by having a sign or other marking posted in the area.

6.28.5.3 Transfer into permanently mounted ASME engine fuel containers on vehicles shall meet the provisions of 6.28.5.3(A) through 6.28.5.3(D).

(A) The delivery valve and nozzle combination shall mate with the filler valve in the receiving container in such a manner that, when they are uncoupled following a transfer of product, not more than 0.24 $in.^3$ (4 cm^3) of product (liquid equivalent) is released to the atmosphere.

(B) Fixed maximum liquid level gauges that are installed on engine fuel and mobile containers in accordance with Table 5.7.4.1(D) shall not be used to determine the maximum permitted filling limit at a low emission transfer site.

(C) The maximum permitted filling limit shall be in accordance with Section 11.5 and shall be determined by an overfilling prevention device or other approved means.

(D) A label shall be placed near the fixed maximum liquid level gauge providing the following instructions: "Do not use this fixed maximum liquid level gauge at low emission transfer stations."

6.28.5.4 Transfer into a stationary ASME container shall meet the provisions of 6.28.5.4(A) through 6.28.5.4(F).

(A) Where transfer is made through a hose of nominal 1 in. (25 mm) size or smaller, the delivery valve and nozzle combination shall not contain an interstitial volume greater than 0.24 in.^{3} (4 cm^3).

(B) Where transfer is made through hose larger than 1 in. (25 mm) nominal size, no more than 0.91 in.^{3} (15 cm^3) of LP-Gas (liquid equivalent) shall be released to the atmosphere during the transfer operation, including the uncoupling of the transfer hose.

(C) Fixed maximum liquid level gauges on low emission transfer systems shall be installed and used to verify the (function) accuracy of liquid level gauges or other liquid level gauging devices.

(D) Fixed maximum liquid level gauges shall not be used in the routine filling of low emission transfer systems.

(E) The use of a float gauge or other approved nonventing device for containers of 2001 gal (7.6 m^3) or larger water capacity shall be the only means for determining the maximum filling limit.

(F) The maximum filling limit for containers of less than 2001 gal (7.6 m^3) water capacity in low emission transfer systems shall be controlled through the use of an overfilling prevention device or other device approved for this service.

Chapter 7 LP-Gas Liquid Transfer

7.1* Scope.

7.1.1 This chapter applies to transfers of liquid LP-Gas from one container to another wherever this transfer involves connections and disconnections in the transfer system or the venting of LP-Gas to the atmosphere.

7.1.2 This chapter also applies to operational safety and methods for determining the quantity of LP-Gas permitted in containers.

7.2 Operational Safety.

7.2.1 Transfer Personnel.

7.2.1.1 Transfer operations shall be conducted by qualified personnel meeting the provisions of Section 4.4.

7.2.1.2 At least one qualified person shall remain in attendance at the transfer operation from the time connections are made until the transfer is completed, shutoff valves are closed, and lines are disconnected.

7.2.1.3 Transfer personnel shall exercise caution to ensure that the LP-Gases transferred are those for which the transfer system and the containers to be filled are designed.

7.2.2 Filling and Evacuating of Containers.

7.2.2.1 Transfer of LP-Gas to and from a container shall be accomplished only by qualified individuals trained in proper handling and operating procedures meeting the requirements of Section 4.4 and in emergency response procedures.

7.2.2.2 When noncompliance with Section 5.2 and Section 5.7 is found, the container owner and user shall be notified in writing.

7.2.2.3 Injection of compressed air, oxygen, or any oxidizing gas into containers to transfer LP-Gas liquid shall be prohibited.

7.2.2.4 When evacuating a container owned by others, the qualified person(s) performing the transfer shall not inject any material other than LP-Gas into the container.

7.2.2.5* Valve outlets on refillable cylinders of 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] or less shall be equipped with a redundant pressuretight seal or one of the following listed connections: CGA 790, CGA 791, or CGA 810, as described in CGA V-1, *Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections.*

7.2.2.6 Where redundant pressure seals are used, they shall be in place whenever the cylinder is not connected for use.

7.2.2.7 Nonrefillable (disposable) and new unused cylinders shall not be required to be equipped with valve outlet seals.

7.2.2.8 Containers shall be filled only after determination that they comply with the design, fabrication, inspection, marking, and requalification provisions of this code.

7.2.2.9 Prior to refilling a cylinder that has a cylinder sleeve, the cylinder sleeve shall be removed to facilitate the visual inspection of the cylinder.

7.2.2.10 "Single trip," "nonrefillable," or "disposable" cylinders shall not be refilled with LP-Gas.

7.2.2.11 Containers shall comply with the following with regard to service or design pressure requirements:

(1) The service pressure marked on the cylinder shall be not less than 80 percent of the vapor pressure of the LP-Gas for which the cylinder is designed at 130°F (54°C).
(2) The maximum allowable working pressure (MAWP) for ASME containers shall be in accordance with Table 5.2.4.2.

7.2.2.12 Transfer of refrigerated product shall be made only into systems that are designed to accept refrigerated product.

7.2.2.13 A container shall not be filled if the container assembly does not meet the requirements for continued service.

7.2.2.14 Transfer hoses larger than ½ in. (12 mm) internal diameter shall not be used for making connections to individual cylinders being filled indoors.

7.2.3 Arrangement and Operation of Transfer Systems.

7.2.3.1 Public access to areas where LP-Gas is stored and transferred shall be prohibited, except where necessary for the conduct of normal business activities.

7.2.3.2 Sources of ignition shall be turned off during transfer operations, while connections or disconnections are made, or while LP-Gas is being vented to the atmosphere.

(A) Internal combustion engines within 15 ft (4.6 m) of a point of transfer shall be shut down while such transfer operations are in progress, with the exception of the following:

(1) Engines of LP-Gas cargo tank vehicles, constructed and operated in compliance with Chapter 9, while such engines are driving transfer pumps or compressors on these vehicles to load containers in accordance with 6.5.2.2
(2) Engines for industrial (and forklift) trucks powered by LP-Gas used in buildings as provided in Section 11.13

(B) Smoking, open flame, portable electrical tools, and extension lights capable of igniting LP-Gas shall not be permitted within 25 ft (7.6 m) of a point of transfer while filling operations are in progress.

(C) Metal cutting, grinding, oxygen–fuel gas cutting, brazing, soldering, or welding shall not be permitted within 35 ft (10.7 m) of a point of transfer while filling operations are in progress.

(D) Materials that have been heated above the ignition temperature of LP-Gas shall be cooled before LP-Gas transfer is started.

(E) Sources of ignition shall be turned off during the filling of any LP-Gas container on the vehicle.

7.2.3.3 Cargo tank vehicles unloading into storage containers shall be at least 10 ft (3 m) from the container and so positioned that the shutoff valves on both the truck and the container are readily accessible.

7.2.3.4 The cargo tank vehicle shall not transfer LP-Gas into dispensing station storage while parked on a public way.

7.2.3.5 Transfers to containers serving agricultural or industrial equipment requiring refueling in the field shall comply with 7.2.3.5(A) and 7.2.3.5(B).

(A)* Where the intake of air-moving equipment is less than 50 ft (15 m) from a point of transfer, it shall be shut down while containers are being refilled.

(B) Equipment employing open flames or equipment with integral containers shall be shut down while refueling.

7.2.3.6 During the time railroad tank cars are on sidings for loading or unloading, the following shall apply:

(1) A caution sign, with wording such as "STOP. TANK CAR CONNECTED," shall be placed at the active end(s) of the siding while the car is connected, as required by DOT regulations.
(2) Wheel chocks shall be placed to prevent movement of the car in either direction.

7.2.3.7 Where a hose or swivel-type piping is used for loading or unloading railroad tank cars, it shall be protected as follows:

(1) An emergency shutoff valve shall be installed at the railroad tank car end of the hose or swivel-type piping where flow into or out of the railroad tank car is possible.
(2) An emergency shutoff valve or a backflow check valve shall be installed on the railroad tank car end of the hose or swivel piping where flow is only into the railroad tank car.

7.2.3.8 Where cargo tank vehicles are filled directly from railroad tank cars on a private track with nonstationary storage tanks involved, the following requirements shall be met:

(1) Transfer protection shall be provided in accordance with Section 6.12.
(2) Ignition source control shall be in accordance with Section 6.23.
(3) Control of ignition sources during transfer shall be provided in accordance with 7.2.3.2.
(4) Fire extinguishers shall be provided in accordance with 9.4.7.
(5) Transfer personnel shall meet the provisions of 7.2.1.
(6) Cargo tank vehicles shall meet the requirements of 7.2.3.
(7) The points of transfer shall be located in accordance with Table 6.5.2.1 with respect to exposures.
(8) Provision for anchorage and breakaway shall be provided on the cargo tank vehicle side for transfer from a railroad tank car directly into a cargo tank vehicle.
(9) The provisions of Chapter 14 shall apply to all LP-Gas transfers performed in accordance with 7.2.3.8.

7.2.3.9 Where cargo tank vehicles are filled from other cargo tank vehicles or cargo tanks, the following requirements shall apply:

(1) Transfer between cargo tanks or cargo tank vehicles where one is used as a bulk plant shall be temporary installations that comply with 4.3.2, 6.19.1, 6.19.2, 6.19.4 through 6.19.6, and 7.2.3.1.
(2) Arrangements and operations of the transfer system shall be in accordance with the following:
    (a) The point of transfer shall be in accordance with Table 6.5.2.1.
    (b) Sources of ignition within the transfer area shall be controlled during the transfer operation as specified in 7.2.3.2.
    (c) Fire extinguishers shall be provided in accordance with 9.4.7.
(3) Cargo tanks shall comply with the requirements of 7.2.2.8.
(4) Provisions designed either to prevent a pull-away during a transfer operation or to stop the flow of products from both cargo tank vehicles or cargo tanks in the event of a pull-away shall be incorporated.
(5) Off-truck remote shutoff devices that meet 49 CFR 173.315(n) requirements and are installed on the cargo tank vehicle unloading the product shall satisfy the requirements of 7.2.3.9(4).
(6) Cargo tank vehicle LP-Gas transfers that are for the sole purpose of testing, maintaining, or repairing the cargo tank vehicle shall be exempt from the requirements of 7.2.3.9(1).

7.2.4 Hose Inspection.

7.2.4.1 Hose assemblies shall be observed for leakage or for damage that could impair their integrity before each use.

7.2.4.2 The hose assemblies specified in 7.2.4.1 shall be inspected at least annually.

7.2.4.3 Inspection of pressurized hose assemblies shall include inspection for the following:

(1) Damage to outer cover that exposes reinforcement
(2) Kinked or flattened hose
(3) Soft spots or bulges in hose
(4) Couplings that have slipped on the hose, are damaged, have missing parts, or have loose bolts
(5) Leakage other than permeability leakage

7.2.4.4 Hose assemblies shall be replaced, repaired, or continued in service based on the results of the inspection.

7.2.4.5 Leaking or damaged hose shall be immediately repaired or removed from service.

7.3 Venting LP-Gas to Atmosphere.

7.3.1 General. LP-Gas in either liquid or vapor form shall not be vented to the atmosphere unless it is vented under the following conditions:

(1) Venting of LP-Gas shall be permitted where the maximum flow from fixed liquid level, rotary, or slip tube gauges does not exceed that from a No. 54 drill orifice.
(2) Venting of LP-Gas between shutoff valves before disconnecting the liquid transfer line from the container shall be permitted.
(3) Venting of LP-Gas, where necessary, shall be permitted to be performed by the use of bleeder valves.
(4) Venting of LP-Gas shall be permitted for the purposes described in 7.3.1(1) and (2) within structures designed for container filling in accordance with Chapter 10.
(5) Venting of LP-Gas vapor from listed liquid transfer pumps using such vapor as a source of energy shall be permitted where the rate of discharge does not exceed the discharge from a No. 31 drill size orifice.
(6) Venting of LP-Gas for purging in accordance with 7.3.2 shall be permitted.
(7) Venting of LP-Gas shall be permitted for emergencies.
(8) Venting of LP-Gas vapor utilized as the pressure source in remote shutdown systems for internal valves and emergency shutoff valves shall be permitted.

7.3.2 Purging.

7.3.2.1 Venting of gas from containers for purging or for other purposes shall be accomplished in accordance with 7.3.2.2 through 7.3.2.4.

7.3.2.2 Venting of cylinders indoors shall only occur in structures designed and constructed for cylinder filling in accordance with 6.5.1.1 and Chapter 10 and with 7.3.2.2(A) through 7.3.2.2(C).

(A) Piping shall be installed to convey the vented product outdoors at least 3 ft (1 m) above the highest point of any building within 25 ft (7.6 m).

(B) Only vapors shall be exhausted to the atmosphere.

(C) If a vent manifold is used to allow for the venting of more than one cylinder at a time, each connection to the vent manifold shall be equipped with a backflow check valve.

7.3.2.3 Venting of containers outdoors shall be performed under conditions that result in rapid dispersion of the product being released.

7.3.2.4 If conditions are such that venting into the atmosphere cannot be accomplished safely, LP-Gas shall be burned at a distance of at least 25 ft (7.6 m) from combustibles.

7.3.2.5 Venting of containers and burning of LP-Gas from containers shall be attended.

7.4 Quantity of LP-Gas in Containers.

7.4.1 Application. Section 7.4 applies to the maximum permissible LP-Gas content of containers and the methods of verifying this quantity. *(See Annex F.)*

7.4.2 LP-Gas Capacity of Containers.

7.4.2.1 The capacity of an LP-Gas container shall be determined either by weight in accordance with 7.4.2.2 or by volume in accordance with 7.4.2.3.

7.4.2.2* The maximum filling limit by weight of LP-Gas in a container shall be in accordance with Table 7.4.2.2.

Table 7.4.2.2 Maximum Filling Limit by Weight of LP-Gas Containers (Percent of Marked Water Capacity in Pounds)

	Aboveground Containers		
Specific Gravity at 60°F (15.6°C)	0 to 1200 gal (0 to 4.5 m^3) Total Water Capacity (%)	>1200 gal (>4.5 m^3) Total Water Capacity (%)	Underground Containers All Water Capacities (%)
0.496–0.503	41	44	45
0.504–0.510	42	45	46
0.511–0.519	43	46	47
0.520–0.527	44	47	48
0.528–0.536	45	48	49
0.537–0.544	46	49	50
0.545–0.552	47	50	51
0.553–0.560	48	51	52
0.561–0.568	49	52	53
0.569–0.576	50	53	54
0.577–0.584	51	54	55
0.585–0.592	52	55	56
0.593–0.600	53	56	57

7.4.2.3* The maximum permitted volume of LP-Gas in a container shall be in accordance with Table 7.4.2.3(a), Table 7.4.2.3(b), and Table 7.4.2.3(c).

7.4.3 General Provisions for Volumetric Method of Filling Containers.

7.4.3.1 The volumetric method shall be limited to the following containers that are designed and equipped for filling by volume:

(1) Cylinders of less than 200 lb (91 kg) water capacity that are not subject to DOT jurisdiction
(2) Cylinders of 200 lb (91 kg) water capacity or more
(3) Cargo tanks or portable tanks
(4) ASME and API-ASME containers complying with 5.2.1.1 or 5.2.4.2

Table 7.4.2.3(a) Maximum Permitted LP-Gas Volume (Percent of Total Container Volume): Aboveground Containers 0 to 1200 gal (0 to 4.5 m³)

Liquid Temperature		Specific Gravity												
°F	°C	0.496 to 0.503	0.504 to 0.510	0.511 to 0.519	0.520 to 0.527	0.528 to 0.536	0.537 to 0.544	0.545 to 0.552	0.553 to 0.560	0.561 to 0.568	0.569 to 0.576	0.577 to 0.584	0.585 to 0.592	0.593 to 0.600
−50	−45.6	70	71	72	73	74	75	75	76	77	78	79	79	80
−45	−42.8	71	72	73	73	74	75	76	77	77	78	79	80	80
−40	−40	71	72	73	74	75	75	76	77	78	79	79	80	81
−35	−37.2	71	72	73	74	75	76	77	77	78	79	80	80	81
−30	−34.4	72	73	74	75	76	76	77	78	78	79	80	81	81
−25	−31.5	72	73	74	75	76	77	77	78	79	80	80	81	82
−20	−28.9	73	74	75	76	76	77	78	79	79	80	81	81	82
−15	−26.1	73	74	75	76	77	77	78	79	80	80	81	82	83
−10	−23.3	74	75	76	76	77	78	79	79	80	81	81	82	83
−5	−20.6	74	75	76	77	78	78	79	80	80	81	82	82	83
0	−17.8	75	76	76	77	78	79	79	80	81	81	82	83	84
5	−15	75	76	77	78	78	79	80	81	81	82	83	83	84
10	−12.2	76	77	77	78	79	80	80	81	82	82	83	84	84
15	−9.4	76	77	78	79	80	80	81	81	82	83	83	84	85
20	−6.7	77	78	78	79	80	80	81	82	83	84	84	84	85
25	−3.9	77	78	79	80	80	81	82	82	83	84	84	85	85
30	−1.1	78	79	79	80	81	81	82	83	83	84	85	85	86
35	1.7	78	79	80	81	81	82	83	83	84	85	85	86	86
40*	4.4	79	80	81	81	82	82	83	84	84	85	86	86	87
45	7.8	80	80	81	82	82	83	84	84	85	85	86	87	87
50	10	80	81	82	82	83	83	84	85	85	86	86	87	88
55	12.8	81	82	82	83	84	84	85	85	86	86	87	87	88
60	15.6	82	82	83	84	84	85	85	86	86	87	87	88	88
65	18.3	82	83	84	84	85	85	86	86	87	87	88	88	89
70	21.1	83	84	84	85	85	86	86	87	87	88	88	89	89
75	23.9	84	85	85	85	86	86	87	87	88	88	89	89	90
80	26.7	85	85	86	86	87	87	87	88	88	89	89	90	90
85	29.4	85	86	87	87	88	88	88	89	89	89	90	90	91
90	32.2	86	87	87	88	88	88	89	89	90	90	90	91	91
95	35	87	88	88	88	89	89	89	90	90	91	91	91	92
100	37.8	88	89	89	89	89	90	90	90	91	91	92	92	92
105	40.4	89	89	90	90	90	90	91	91	91	92	92	92	93
110	43	90	90	91	91	91	91	92	92	92	92	93	93	93
115	46	91	91	92	92	92	92	92	92	93	93	93	94	94
120	49	92	92	93	93	93	93	93	93	93	94	94	94	94
125	51.5	93	94	94	94	94	94	94	94	94	94	94	95	95
130	54	94	95	95	95	95	95	95	95	95	95	95	95	95

*See 7.4.3.2(A).

7.4.3.2 Where used, the volumetric method shall be in accordance with 7.4.3.2(A) through 7.4.3.2(C).

(A) If a fixed maximum liquid level gauge or a variable liquid level gauge without liquid volume temperature correction is used, the liquid level indicated by these gauges shall be computed based on the maximum permitted filling limit when the liquid is at 40°F (4°C) for aboveground containers or at 50°F (10°C) for underground containers.

(B) When a variable liquid level gauge is used and the liquid volume is corrected for temperature, the maximum permitted liquid level shall be in accordance with Table 7.4.2.3(a) through Table 7.4.2.3(c).

Table 7.4.2.3(b) Maximum Permitted LP-Gas Volume (Percent of Total Container Volume): Aboveground Containers Over 1200 gal (Over 4.5 m^3)

Liquid Temperature		Specific Gravity												
°F	°C	0.496 to 0.503	0.504 to 0.510	0.511 to 0.519	0.520 to 0.527	0.528 to 0.536	0.537 to 0.544	0.545 to 0.552	0.553 to 0.560	0.561 to 0.568	0.569 to 0.576	0.577 to 0.584	0.585 to 0.592	0.593 to 0.600
−50	−45.6	75	76	77	78	79	80	80	81	82	83	83	84	85
−45	−42.8	76	77	78	78	79	80	81	81	82	83	84	84	85
−40	−40	76	77	78	79	80	80	81	82	83	83	84	85	85
−35	−37.2	77	78	78	79	80	81	82	82	83	84	84	85	86
−30	−34.4	77	78	79	80	80	81	82	83	83	84	85	85	86
−25	−31.5	78	79	79	80	81	82	82	83	84	84	85	86	86
−20	−28.9	78	79	80	81	81	82	83	83	84	85	85	86	87
−15	−26.1	79	79	80	81	82	82	83	84	85	85	86	87	87
−10	−23.3	79	80	81	82	82	83	84	84	85	86	86	87	87
−5	−20.6	80	81	81	82	83	83	84	85	85	86	87	87	88
0	−17.8	80	81	82	82	83	84	84	85	86	86	87	88	88
5	−15	81	82	82	83	84	84	85	86	86	87	87	88	89
10	−12.2	81	82	83	83	84	85	85	86	87	87	88	88	89
15	−9.4	82	83	83	84	85	85	86	87	87	88	88	89	90
20	−6.7	82	83	84	85	85	86	86	87	88	88	89	89	90
25	−3.9	83	84	84	85	86	86	87	88	88	89	89	90	90
30	−1.1	83	84	85	86	86	87	87	88	89	89	90	90	91
35	1.7	84	85	86	86	87	87	88	89	89	90	90	91	91
40*	4.4	85	86	86	87	87	88	88	89	90	90	91	91	92
45	7.8	85	86	87	87	88	88	89	89	90	91	91	92	92
50	10	86	87	87	88	88	89	90	90	91	91	92	92	92
55	12.8	87	88	88	89	89	90	90	91	91	92	92	92	93
60	15.6	88	88	89	89	90	90	91	91	92	92	93	93	93
65	18.3	88	89	90	90	91	91	91	92	92	93	93	93	94
70	21.1	89	90	90	91	91	91	92	92	93	93	94	94	94
75	23.9	90	91	91	91	92	92	92	93	93	94	94	94	95
80	26.7	91	91	92	92	92	93	93	93	94	94	95	95	95
85	29.4	92	92	93	93	93	93	94	94	95	95	95	96	96
90	32.2	93	93	93	94	94	94	95	95	95	95	96	96	96
95	35	94	94	94	95	95	95	95	96	96	96	96	97	97
100	37.8	94	95	95	95	95	96	96	96	96	97	97	97	98
105	40.4	96	96	96	96	96	97	97	97	97	97	98	98	98
110	43	97	97	97	97	97	97	97	98	98	98	98	98	99
115	46	98	98	98	98	98	98	98	98	98	99	99	99	99

*See 7.4.3.2(A).

(C) ASME containers with a water capacity of 1200 gal (4.5 m^3) or less filled by the volumetric method shall be gauged in accordance with 7.4.3.2(A), utilizing the fixed maximum liquid level gauge, except that containers fabricated on or before December 31, 1965, shall be exempt from this provision.

7.4.3.3 Where containers are to be filled volumetrically by a variable liquid level gauge in accordance with 7.4.3.2(B), provisions shall be made for determining the liquid temperature.

7.4.4* Overfilling.

7.4.4.1 An overfilling prevention device shall not be the primary means to determine when a cylinder is filled to the maximum allowable filling limit.

7.4.4.2 Other means specified in this chapter shall be used to prevent the overfilling of cylinders.

Table 7.4.2.3(c) Maximum Permitted LP-Gas Volume (Percent of Total Container Volume): All Underground Containers

Liquid Temperature		Specific Gravity												
°F	°C	0.496 to 0.503	0.504 to 0.510	0.511 to 0.519	0.520 to 0.527	0.528 to 0.536	0.537 to 0.544	0.545 to 0.552	0.553 to 0.560	0.561 to 0.568	0.569 to 0.576	0.577 to 0.584	0.585 to 0.592	0.593 to 0.600
–50	–45.6	77	78	79	80	80	81	82	83	83	84	85	85	86
–45	–42.8	77	78	79	80	81	82	82	83	84	84	85	86	87
–40	–40	78	79	80	81	81	82	83	83	84	85	86	86	87
–35	–37.2	78	79	80	81	82	82	83	84	85	85	86	87	87
–30	–34.4	79	80	81	81	82	83	84	84	85	86	86	87	88
–25	–31.5	79	80	81	82	83	83	84	85	85	86	87	87	88
–20	–28.9	80	81	82	82	83	84	84	85	86	86	87	88	88
–15	–26.1	80	81	82	83	84	84	85	86	86	87	87	88	89
–10	–23.3	81	82	83	83	84	85	85	86	87	87	88	88	89
–5	–20.6	81	82	83	84	84	85	86	86	87	88	88	89	89
0	–17.8	82	83	84	84	85	85	86	87	87	88	89	89	90
5	–15	82	83	84	85	85	86	87	87	88	88	89	90	90
10	–12.2	83	84	85	85	86	86	87	88	88	89	90	90	91
15	–9.4	84	84	85	86	86	87	88	88	89	89	90	91	91
20	–6.7	84	85	86	86	87	88	88	89	89	90	90	91	91
25	–3.9	85	86	86	87	87	88	89	89	90	90	91	91	92
30	–1.1	85	86	87	87	88	89	89	90	90	91	91	92	92
35	1.7	86	87	87	88	88	89	90	90	91	91	92	92	93
40	4.4	87	87	88	88	89	90	90	91	91	92	92	93	93
45	7.8	87	88	89	89	90	90	91	91	92	92	93	93	94
50*	10	88	89	89	90	90	91	91	92	92	93	93	94	94
55	12.8	89	89	90	91	91	91	92	92	93	93	94	94	95
60	15.6	90	90	91	91	92	92	92	93	93	94	94	95	95
65	18.3	90	91	91	92	92	93	93	94	94	94	95	95	96
70	21.1	91	91	92	93	93	93	94	94	94	95	95	96	96
75	23.9	92	93	93	93	94	94	94	95	95	95	96	96	97
80	26.7	93	93	94	94	94	95	95	95	96	96	96	97	97
85	29.4	94	94	95	95	95	95	96	96	96	97	97	97	98
90	32.2	95	95	95	95	96	96	96	97	97	97	98	98	98
95	35	96	96	96	96	97	97	97	97	98	98	98	98	99
100	37.8	97	97	97	97	97	98	98	98	98	99	99	99	99
105	40.4	98	98	98	98	98	98	98	99	99	99	99	99	99

*See 7.4.3.2(A).

Chapter 8 Storage of Cylinders Awaiting Use, Resale, or Exchange

8.1 Scope.

8.1.1 The provisions of this chapter apply to the storage of cylinders of 1000 lb (454 kg) water capacity or less, whether filled, partially filled, or empty, as follows:

(1) At consumer sites or dispensing stations, where not connected for use
(2) In storage for resale or exchange by dealer or reseller

8.1.2 This chapter does not apply to new or unused cylinders.

8.1.3 This chapter does not apply to cylinders stored at bulk plants.

8.2 General Provisions.

8.2.1 General Location of Cylinders.

8.2.1.1 Cylinders in storage shall be located to minimize exposure to excessive temperature rises, physical damage, or tampering.

8.2.1.2 Cylinders in storage having individual water capacity greater than 2.7 lb (1.1 kg) [nominal 1 lb (0.45 kg) LP-Gas capacity] shall be positioned so that the pressure relief valve is in direct communication with the vapor space of the cylinder.

8.2.1.3 Cylinders stored in buildings in accordance with Section 8.3 shall not be located near exits, near stairways, or in areas normally used, or intended to be used, for the safe egress of occupants.

8.2.1.4 If empty cylinders that have been in LP-Gas service are stored indoors, they shall be considered as full cylinders for the purposes of determining the maximum quantities of LP-Gas permitted by 8.3.1, 8.3.2.1, and 8.3.3.1.

8.2.1.5 Cylinders shall not be stored on roofs.

8.2.2 Protection of Valves on Cylinders in Storage.

8.2.2.1 Cylinder valves shall be protected as required by 5.2.6.1 and 7.2.2.5.

8.2.2.2 Screw-on-type caps or collars shall be in place on all cylinders stored, regardless of whether they are full, partially full, or empty, and cylinder outlet valves shall be closed.

8.2.2.3 Valve outlets on cylinders less than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] shall be plugged, capped, or sealed in accordance with 7.2.2.5.

8.3 Storage Within Buildings.

8.3.1 General. Storage of cylinders in buildings shall be in accordance with Table 8.3.1(a) or Table 8.3.1(b) or the requirements of Section 8.3.

Table 8.3.1(a) Maximum Allowable Storage Quantities of LP-Gas in Other Than Industrial, Storage, and Mercantile Occupancies

Occupancy	Assembly	Educational	Day Care	Health Care	Ambulatory Health Care	Detention and Correctional	One- and Two-Family Dwellings	Lodging or Rooming House	Hotel and Dormitory	Apartment	Residential Board and Care	Business
Maximum Allowable Quantity (MAQ):												
Storage (state units: lb, gal, etc.)	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
MAQ increases for:							Maximum 1 lb cylinders			1 lb cylinder		
Total (including cabinets)	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
Total for suppression	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
Total for both cabinets and suppression	0	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
Attended catered food service per NFPA 58 in 10 oz maximum cylinders	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb
			15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb
Additional 10 oz cylinders w/2-hr fire wall	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb	15 lb
Other												
Total (including threshold) for other	20 lb	20 lb	0	5 lb								
	Flame effects per NFPA 160. Additional 20 lb units with 20 ft (6 m) separation.	In labs, not in classrooms. Additional 20 lb units with 20 ft (6 m) separation.		In labs only. Additional 5 lb units with 20 ft separation.						Amounts per dwelling		

For SI units, 1 lb = 0.45 kg; 1 oz = 0.028 kg.

Table 8.3.1(b) Maximum Allowable Storage Quantities of LP-Gas in Mercantile, Industrial, and Storage Occupancies

Occupancy	Mercantile	Industrial	Storage
Maximum Allowable Quantity (MAQ): Storage (state units: lb, gal, etc.)	200 lb (1 lb maximum/ cylinder)	300 lb	300 lb
MAQ increases for: Total (including threshold) for cabinets	200 lb	300 lb	300 lb
Total (including threshold) for suppression	200 lb	300 lb	300 lb
Total (including threshold) for both cabinets and suppression	200 lb	300 lb	300 lb
Total (including threshold) for other (describe)	1000 lb Separation of groups of 200 lb by 50 ft and a sprinkler density of 0.300 gpm (1.1 L/min) over the most remote 2000 ft^2 (18.6 m^2) area and 250 gpm (946 L/min) hose stream allowance	Additional 300 lb 300 ft separation	10,000 lb In special rooms or buildings per Chapter 10

For SI units, 1 lb = 0.45 kg; 1 gpm = 3.8 L/min; 1 ft = 0.3 m; 1 ft^2 = 0.09 m^2.

8.3.2 Storage Within Buildings Frequented by Public.

8.3.2.1 The quantity of LP-Gas in cylinders stored or displayed shall not exceed 200 lb (91 kg) in one location, with additional storage separated by 50 ft (15 m). The maximum quantity to be stored in one building shall not exceed 1000 lb (454 kg).

(A) Where the total quantity stored in a building exceeds 200 lb (91 kg), an approved sprinkler system that, at a minimum, meets the requirement of NFPA 13, *Standard for the Installation of Sprinkler Systems*, for Ordinary Hazard (Group 2) shall be installed.

(B) The sprinkler density shall be 0.300 gpm/ft^2 (12.2 mm/min) over the most remote 2000 ft^2 (18.6 m^2) area, and the hose stream allowance shall be 250 gpm (946 L/min).

8.3.2.2 The cylinders shall not exceed a water capacity of 2.7 lb (1.1 kg) [nominal 1 lb (0.45 kg) LP-Gas].

8.3.2.3 In restaurants and at food service locations, storage of 10 oz (283 g) butane nonrefillable containers shall be limited to not more than 24 containers and 24 additional 10 oz (283 g) butane nonrefillable containers stored in another location within the building where constructed with at least 2-hour fire wall protection.

8.3.3 Storage Within Buildings Not Frequented by Public.

8.3.3.1 The maximum quantity of LP-Gas allowed in one storage location shall not exceed 735 lb (334 kg) water capacity [nominal 300 lb (136 kg) propane capacity].

8.3.3.2 Where additional storage locations are required on the same floor within the same building, they shall be separated by a minimum of 300 ft (91.4 m).

8.3.3.3 Storage beyond the limitations described in 8.3.3.2 shall comply with 8.3.4.

8.3.3.4 Cylinders carried as part of the service equipment on highway mobile vehicles shall not be part of the total storage capacity requirements of 8.3.3.1, where such vehicles are stored in private garages and carry no more than three cylinders with a total aggregate capacity per vehicle not exceeding 100 lb (45.4 kg) of propane.

8.3.3.5 Cylinder valves shall be closed when not in use.

8.3.4 Storage Within Special Buildings or Rooms.

8.3.4.1 The maximum quantity of LP-Gas stored in special buildings or rooms shall be 10,000 lb (4540 kg).

8.3.4.2 Special buildings or rooms for storing LP-Gas cylinders shall not be located where the buildings or rooms adjoin the line of property occupied by schools, churches, hospitals, athletic fields, or other points of public gathering.

8.3.4.3 The construction of all special buildings and rooms specified in 8.3.4.2 shall comply with Chapter 10 and the following:

(1) Vents to the outside only shall be provided at both the top and bottom of the building and shall be located at least 5 ft (1.5 m) from any building opening.
(2) The entire area shall be classified for purposes of ignition source control in accordance with Section 6.23.

8.3.5 Storage Within Residential Buildings. Storage of cylinders within a residential building, including the basement or any storage area in a common basement of a multiple-family building and attached or detached garages, shall be limited to cylinders each with a maximum water capacity of 2.7 lb (1.2 kg) and shall not exceed 5.4 lb (2.4 kg) aggregate water capacity per each living space unit.

8.4 Storage Outside of Buildings.

8.4.1* Location of Storage Outside of Buildings.

8.4.1.1 Storage outside of buildings for cylinders awaiting use or resale or that are part of a cylinder exchange point shall be located as follows:

(1) At least 5 ft (1.5 m) from any doorway or opening in a building frequented by the public where occupants have at least two means of egress as defined by NFPA *101, Life Safety Code*
(2) At least 10 ft (3 m) from any doorway or opening in a building or sections of a building that has only one means of egress
(3) At least 20 ft (6.1 m) from any automotive service station fuel dispenser

8.4.1.2 Distances from cylinders in storage outside of buildings shall be in accordance with Table 8.4.1.2 with respect to the following:

(1) Nearest important building or group of buildings

Table 8.4.1.2 Distances from Cylinders in Storage and Exposures

Quantity of LP-Gas Stored		Horizontal Distance to ... (1) and (2)		(3) and (4)		(5)	
lb	kg	ft	m	ft	m	ft	m
≤720	≤227	0	0	0	0	5	1.5
721–2,500	>227–1,134	0	0	10	3	10	3
2,501–6,000	>1,134–2,721	10	3	10	3	10	3
6,001–10,000	>2,721–4,540	20	6.1	20	6.1	20	6.1
>10,000	>4,540	25	7.6	25	7.6	25	7.6

(2) Line of adjoining property that can be built upon
(3) Busy thoroughfares or sidewalks on other than private property
(4) Line of adjoining property occupied by schools, churches, hospitals, athletic fields, or other points of public gathering
(5) Dispensing station

8.4.1.3 Fire-Resistive Protective Structure.

(A) The distances in Table 8.4.1.2 shall be reduced to 0 where a 2-hour fire-resistive protective structure made of noncombustible materials is provided that breaks the line of sight of the storage and the building.

(B) For buildings with exterior walls rated 2-hour fire resistance and constructed of noncombustible materials not provided with eaves over the storage, the exterior wall shall be allowed in lieu of a protective structure to reduce the distance to 0.

8.4.1.4 Cylinders in the filling process shall not be considered to be in storage.

8.4.2 Protection of Cylinders.

8.4.2.1* Cylinders at a location open to the public shall be protected by either of the following:

(1) An enclosure in accordance with 6.19.4.2
(2) A lockable ventilated enclosure of metal exterior construction

8.4.2.2* Vehicular barrier protection (VBP) shall be provided where vehicle traffic is expected at the location.

8.4.3 Alternate Location and Protection of Storage. Where the provisions of 8.4.1 and 8.4.2.1 are impractical at construction sites or at buildings or structures undergoing major renovation or repairs, alternative storage of cylinders shall be acceptable to the authority having jurisdiction.

8.5* Fire Protection and Electrical Area Classification.

8.5.1 Retail cylinder exchange locations shall be provided with at least one approved portable fire extinguisher having a minimum capacity of 10 lb (4.5 kg) dry chemical with an A:B:C rating complying with 8.5.3 on the premises where retail cylinder exchange cabinets are storing more than 720 lb (327 kg) of propane.

8.5.2 Storage locations, other than those complying with 8.5.1, where the aggregate quantity of propane stored is in excess of 720 lb (327 kg), shall be provided with at least one approved portable fire extinguisher having a 40-B:C or 80-B:C rating and a minimum capacity of 18 lb (8.2 kg) dry chemical.

8.5.3 The required fire extinguisher shall be located in accordance with 8.5.3.1 or 8.5.3.2.

8.5.3.1 A 40-B:C fire extinguisher shall be located not more than 30 ft (10 m) from the propane storage location.

8.5.3.2 An 80-B:C fire extinguisher shall be located not more than 50 ft (15 m) from the propane storage location.

8.5.4 Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

8.5.5 The storage of cylinders awaiting resale shall be exempt from the electrical classification requirements of this code.

8.6 Automated Cylinder Exchange Stations.

8.6.1 Cylinder exchange cabinets that include an automated vending system for exchanging cylinders shall comply with the requirements in 8.6.2 through 8.6.6.

8.6.2 Electrical equipment installed in cylinder storage compartments shall comply with the requirements for Class I, Division 2 equipment in accordance with *NFPA 70, National Electrical Code.*

8.6.3 Cabinets shall be designed such that cylinders can be placed inside only in the upright position.

8.6.4 Door releases for access to stored cylinders shall be permitted to be pneumatic, mechanical, or electrically powered.

8.6.5 A manual override control shall be permitted for use by authorized personnel.

8.6.6 The vending system shall not be capable of returning to automatic operation after a manual override until the system has been inspected and reset by authorized personnel.

Chapter 9 Vehicular Transportation of LP-Gas

9.1 Scope.

9.1.1 This chapter applies to containers, container appurtenances, piping, valves, equipment, and vehicles used in the transportation of LP-Gas, as follows:

(1) Transportation of cylinders
(2) Transportation in cargo tank vehicles, whether fabricated by mounting cargo tanks on conventional truck or trailer chassis or constructed as integral cargo units in which the container constitutes in whole, or in part, the stress member of the vehicle frame
(3)*Transfer equipment and piping and the protection of such equipment and the container appurtenances against overturn, collision, or other vehicular accidents

9.1.2 This chapter does not apply to the following:

(1) Cylinders and related equipment incident to their use on vehicles as covered in Section 6.24 and Chapter 11
(2) Transportation of LP-Gas containers on vehicles where the containers are used to fuel the vehicle or appliances located on the vehicle as covered in Sections 6.24, 11.15, and 11.16
(3)*LP-Gas systems used for engine fuel

9.2 Electrical Requirements.

9.2.1 Only electrical lighting shall be used with the vehicles covered by this chapter.

9.2.2 Wiring shall be insulated and protected from physical damage.

9.3 Transportation in Portable Containers.

9.3.1 Application. Section 9.3 shall apply to the vehicular transportation of portable containers filled with LP-Gas delivered as "packages," including containers built to DOT cylinder specifications and other portable containers.

9.3.2 Transportation of Cylinders.

9.3.2.1 Cylinders having an individual water capacity not exceeding 1000 lb (454 kg) [nominal 420 lb (191 kg) propane capacity], when filled with LP-Gas, shall be transported in accordance with the requirements of Section 9.3.

9.3.2.2 Cylinders shall be constructed as provided in Section 5.2 and equipped in accordance with Section 5.7 for transportation as cylinders.

9.3.2.3 The quantity of LP-Gas in cylinders shall be in accordance with Chapter 7.

9.3.2.4 Cylinder valves shall comply with the following:

(1) Valves of cylinders shall be protected in accordance with 5.2.6.1.
(2) Screw-on-type protecting caps or collars shall be secured in place.
(3) The provisions of 7.2.2.5 shall apply.

9.3.2.5 The cargo space of the vehicle shall be isolated from the driver's compartment, the engine, and the engine's exhaust system.

(A) Open-bodied vehicles shall be considered to be in compliance with this provision.

(B) Closed-bodied vehicles having separate cargo, driver, and engine compartments shall be considered to be in compliance with this provision.

(C) Closed-bodied vehicles, such as passenger cars, vans, and station wagons, shall not be used for transporting more than 215 lb (98 kg) water capacity [nominal 90 lb (41 kg) propane capacity], but not more than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] per cylinder, unless the driver and engine compartments are separated from the cargo space by a vaportight partition that contains no means of access to the cargo space.

9.3.2.6 Cylinders and their appurtenances shall be determined to be leak-free before being loaded into vehicles.

9.3.2.7 Cylinders shall be loaded into vehicles with flat floors or equipped with racks for holding cylinders.

9.3.2.8 Cylinders shall be fastened in position to minimize the possibility of movement, tipping, and physical damage.

9.3.2.9 Cylinders being transported by vehicles shall be positioned in accordance with Table 9.3.2.9.

9.3.2.10 Vehicles transporting cylinders where the total weight is more than 1000 lb (454 kg), including the weight of the LP-Gas and the cylinders, shall be placarded as required by DOT regulations or state law.

9.3.3 Transportation of Portable Containers of More Than 1000 lb (454 kg) Water Capacity.

9.3.3.1 Portable containers having an individual water capacity exceeding 1000 lb (454 kg) [nominal 420 lb (190 kg) propane capacity] when filled with LP-Gas shall be transported in compliance with the requirements of 9.3.3.

Table 9.3.2.9 Orientation of Cylinders on Vehicles

Propane Capacity of Cylinder			
lb	kg	Open Vehicles	Enclosed Spaces of Vehicles
≤45	≤20	Any position	
>45	>20	Relief valve in communication with the vapor space	
≤4.2	≤1.9		Any position
>4.2	>1.9		Relief valve in communication with the vapor space

9.3.3.2 Portable containers shall be constructed in accordance with Section 5.2 and equipped in accordance with Section 5.7 for portable use and shall comply with DOT portable tank specifications for LP-Gas service.

9.3.3.3 The quantity of LP-Gas put into portable containers shall be in accordance with Chapter 7.

9.3.3.4 Valves and other portable container appurtenances shall be protected in accordance with 5.2.6.2.

9.3.3.5 Transportation of portable containers and their appurtenances shall be in accordance with the following:

(1) Portable containers and their appurtenances shall be leak-free before being loaded into vehicles.
(2) Portable containers shall be transported in a rack or frame or on a flat surface.
(3) Portable containers shall be fastened in a position to minimize the possibility of movement, tipping, or physical damage, relative to each other or to the supporting structure, while in transit.

9.3.3.6 Portable containers shall be transported with pressure relief devices in communication with the vapor space.

9.3.3.7 Vehicles carrying more than 1000 lb (454 kg), including the weight of the propane and the portable containers, shall be placarded as required by DOT regulations or state law.

9.3.3.8 Where portable containers complying with the requirements of 9.3.3 are installed permanently or semipermanently on vehicles to serve as cargo tanks, so that the assembled vehicular unit can be used for making liquid deliveries to other containers at points of use, the provisions of Section 9.4 shall apply.

9.3.4 Transportation of Portable Storage Containers. ASME containers to be used as portable storage containers, including movable fuel storage tenders and farm carts for temporary stationary service (normally not more than 12 months duration at any location), when moved shall contain a liquid volume of 5 percent or less of the water capacity of the container, except for agricultural purposes where allowed in a DOT exemption.

9.3.5 Fire Extinguishers.

9.3.5.1 Each truck or trailer transporting portable containers in accordance with 9.3.2 or 9.3.3 shall be equipped with at least one approved portable fire extinguisher having a minimum capacity of 18 lb (8.2 kg) dry chemical with a B:C rating.

9.3.5.2 Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

9.4 Transportation in Cargo Tank Vehicles.

9.4.1 Application.

9.4.1.1 Section 9.4 applies to cargo tank vehicles used for the transportation of LP-Gas as liquid cargo.

9.4.1.2 Transfer shall be made by a pump or compressor mounted on the vehicle or by a transfer means at the delivery point.

9.4.1.3 All LP-Gas cargo tank vehicles, whether used in interstate or intrastate service, shall comply with the applicable portion of the U.S. Department of Transportation Hazardous Materials Regulations of the DOT Federal Motor Carrier Safety Regulations (49 CFR, Parts 171–180, 393, 396, and 397) and shall also comply with any added requirements of this code.

9.4.2 Cargo Tanks Mounted on, or a Part of, Cargo Tank Vehicles.

9.4.2.1 Cargo tanks mounted on, or comprising in whole or in part, the stress member used in lieu of a frame for cargo tank vehicles shall comply with DOT cargo tank vehicle specifications for LP-Gas service.

9.4.2.2 The cargo tanks specified in 9.4.2.1 shall also comply with Section 5.2 and be equipped with appurtenances for cargo service as provided in Section 5.7.

9.4.2.3 Liquid hose of 1½ in. (38 mm) (nominal size) and larger and vapor hose of 1¼ in. (32 mm) (nominal size) and larger shall be protected with an internal valve that is fitted for remote closure and automatic shutoff using thermal (fire) actuation.

9.4.2.4 Where flow is only into the cargo tank, a backflow check valve or an internal valve shall be installed in the cargo tank.

9.4.3 Piping (Including Hose), Fittings, and Valves.

9.4.3.1 Pipe, tubing, pipe and tubing fittings, valves, hose, and flexible connectors shall comply with the following:

(1) Section 5.9
(2) The provisions of DOT cargo tank vehicle specifications for LP-Gas
(3) The service pressure rating specified in 5.17.1.2

9.4.3.2 The following shall also apply to pipe, tubing, pipe and tubing fittings, valves, hose, and flexible connectors:

(1) Pipe shall be wrought iron, steel, brass, or copper in accordance with 5.9.3.1.
(2) Tubing shall be steel, brass, or copper in accordance with 5.9.3.2.
(3) Pipe and tubing fittings shall be steel, brass, copper, malleable iron, or ductile (nodular) iron suitable for use with the pipe or tubing used as specified in 9.4.3.2(1) or (2).
(4) Pipe joints shall be threaded, flanged, welded, or brazed, and fittings, where used, shall comply with 9.4.3.2(3).
(5) Where joints are threaded, or threaded and back welded, pipe and nipples shall be Schedule 80 or heavier.
(6) Copper or brass pipe and nipples shall be of equivalent strength as Schedule 80 steel pipe or heavier.
(7) Where joints are welded or brazed, the pipe and nipples shall be Schedule 40 or heavier.
(8) The pressure ratings of fittings or flanges shall comply with Table 5.17.1.2.
(9) Brazed joints shall be made with a brazing material having a melting point exceeding 1000°F (538°C).
(10) Tubing joints shall be brazed using a brazing material having a melting point of at least 1000°F (538°C).

9.4.3.3 Pipe, tubing, pipe and tubing fittings, valves, hose, and flexible connectors, and complete cargo tank vehicle piping systems including connections to equipment, after assembly, shall comply with 5.17.1.2.

9.4.3.4 Valves, including shutoff valves, excess-flow valves, backflow check valves, and remotely controlled valves, used in piping shall comply with the following:

(1) DOT cargo tank vehicle specifications for LP-Gas service
(2) Section 5.12
(3) Pressure rating requirements of 5.17.1.2

9.4.3.5 Hose, hose connections, and flexible connectors shall comply with 5.9.6 and 9.4.3.1.

9.4.3.6 Flexible connectors used in the piping system to compensate for stresses and vibration shall be limited to 3 ft (1 m) in overall length and, when replaced, shall comply with 5.9.6.

9.4.3.7 Flexible hose connectors shall comply with the following:

(1) Flexible hose connectors shall be permanently marked to indicate the date of installation of the flexible hose connector.
(2) The flexible hose portion of the connector shall be replaced with an unused connector within 10 years of the indicated date of installation of the connector and visually inspected before the first delivery of each day.
(3) The flexible hose portion of flexible connectors shall be replaced whenever a cargo tank unit is remounted on a different chassis, or whenever the cargo tank unit is repiped if such repiping encompasses that portion of piping in which the connector is located.
(4) Replacement of the flexible hose portion of the flexible connector shall not be required if the reinstallation or repiping is performed within 1 year of the date of assembly of the connector.

9.4.3.8 All threaded primary valves and fittings used in liquid filling or vapor equalization directly on the cargo tank of transportation equipment shall be of steel, malleable iron, or ductile iron construction.

9.4.3.9 All existing equipment shall be so equipped as described in 9.4.3.8 not later than the scheduled requalification date of the container.

9.4.4 Equipment.

9.4.4.1 LP-Gas equipment, such as pumps, compressors, meters, dispensers, regulators, and strainers, shall comply with Section 5.17 for design and construction and shall be installed in accordance with the applicable provisions of Section 6.18.

9.4.4.2 Equipment on cargo tank vehicles shall be mounted in place and connected to the fixed piping system in accordance with the manufacturer's instructions.

9.4.4.3 Cargo tank openings whose only function is for pump bypass return shall be provided with one of the following:

(1) A positive shutoff valve capable of being secured in the open position and located as close to the tank as practical in combination with a steel backflow check valve installed in the tank
(2) An internal valve with excess-flow protection
(3) A valve that is specifically recommended and listed by the manufacturer for bypass return service and that meets the requirements of 6.18.2.3

9.4.4.4 Where an electric drive is used to power pumps or compressors mounted on vehicles and the energy is obtained from the electrical installation at the delivery point, the installation on the vehicle shall comply with 6.23.2.1.

9.4.4.5 Where wet hose is carried while connected to the truck's liquid pump discharge piping, an automatic device such as a differential back pressure valve shall be installed between the pump discharge and the hose connection to prevent liquid discharge while the pump is not operating.

(A) Where a meter or dispenser is used, the automatic device specified in 9.4.4.5 shall be installed between the meter outlet and the hose connection.

(B) If an excess-flow valve is used, it shall not be the exclusive means of complying with the provision of 9.4.4.5.

9.4.5 Protection of Cargo Tank Appurtenances, Piping System, and Equipment. Cargo tank appurtenances, piping, and equipment comprising the complete LP-Gas system on the cargo tank vehicle shall be mounted in position *(see 9.4.2.1 for container mounting)*, shall be protected against damage, and shall be in accordance with DOT regulations.

9.4.6 Painting and Marking Cargo Tank Vehicles.

9.4.6.1 Painting of cargo tank vehicles shall comply with 49 CFR.

9.4.6.2 Placarding and marking shall comply with 49 CFR.

9.4.7* Fire Extinguishers.

9.4.7.1 Each cargo tank vehicle or tractor shall be provided with at least one approved portable fire extinguisher having a minimum capacity of 18 lb (8.2 kg) dry chemical with a B:C rating.

9.4.7.2 Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

9.4.8* Wheel Stops for Cargo Tank Vehicles. Each cargo tank vehicle or trailer shall utilize a wheel stop, in addition to the parking or hand brake, whenever the cargo tank vehicle is loading, unloading, or parked.

9.4.9 Exhaust Systems. The truck engine exhaust system shall comply with *Federal Motor Carrier Safety Regulations.*

9.4.10 Smoking Prohibition. No person shall smoke or carry lighted smoking material as follows:

(1) On or within 25 ft (7.6 m) of a vehicle that contains LP-Gas liquid or vapor
(2) At points of liquid transfer
(3) When delivering or connecting to containers

9.5 Trailers, Semitrailers, and Movable Fuel Storage Tenders, Including Farm Carts.

9.5.1 Application. Section 9.5 applies to all cargo tank vehicles, other than trucks, that are parked at locations other than bulk plants.

9.5.2 Fuel Storage Tenders Including Farm Carts.

9.5.2.1 Movable fuel storage tenders including farm carts *(see 3.3.44, Movable Fuel Storage Tender)* shall comply with Section 9.5.

9.5.2.2 Where used over public ways, movable fuel storage tenders shall comply with applicable state regulations.

9.5.2.3 Movable fuel storage tenders shall be constructed in accordance with Section 5.2 and equipped with appurtenances as provided in Section 5.7.

9.5.2.4 Threaded piping shall be not less than Schedule 80, and fittings shall be designed for not less than 250 psig (1.7 MPag).

9.5.2.5 Piping, hose, and equipment, including valves, fittings, pressure relief valves, and container accessories, shall be protected against collision or upset.

9.5.2.6 Movable fuel storage tenders shall comply with the following:

(1) Movable fuel storage tenders shall be so positioned that container pressure relief valves communicate with the vapor space.
(2) Movable fuel storage tenders shall not be filled on a public way.
(3) Movable fuel storage tenders shall contain no more than 5 percent of their water capacity in liquid form during transportation to or from the bulk plant.
(4) Movable fuel storage tenders shall be moved on the shortest practical route when transporting tenders between points of utilization.

9.6 Transportation of Stationary Containers to and from Point of Installation.

9.6.1 Application.

9.6.1.1 Section 9.6 applies to the transportation of containers designed for stationary service at the point of use and secured to the vehicle only for transportation.

9.6.1.2 Containers described in 9.6.1.1 shall be transported in accordance with 9.6.2.

9.6.2 Transportation of Containers.

9.6.2.1 ASME containers of 125 gal (0.5 m^3) or more water capacity shall contain no more than 5 percent of their water capacity in liquid form during transportation.

9.6.2.2 Where a container is transported with more LP-Gas than 5 percent of its water capacity in a liquid form, all of the following conditions shall apply:

(1) The container shall not be filled beyond the filling limit of Section 7.4.
(2) Transportation shall be permitted only to move containers from a stationary or temporary installation to a bulk plant.
(3) Valves and fittings shall be protected by a method approved by the authority having jurisdiction to minimize the possibility of damage.
(4) Lifting lugs shall not be used to move these containers.

9.6.2.3 Containers shall be installed to minimize movement relative to each other or to the carrying vehicle while in transit, giving consideration to vehicular operation.

9.6.2.4 Valves, regulators, and other container appurtenances shall be protected against physical damage during transportation.

9.6.2.5 Pressure relief valves shall be in direct communication with the vapor space of the container.

9.7 Parking and Garaging Vehicles Used to Carry LP-Gas Cargo.

9.7.1 Application. Section 9.7 applies to the parking and garaging of vehicles used for the transportation of LP-Gas.

9.7.2 Parking Outdoors.

9.7.2.1 Vehicles shall not be left unattended on any street, highway, avenue, or alley, except for necessary absences from the vehicle associated with drivers' normal duties, including stops for meals and rest stops during the day or night, except as follows:

(1) This requirement shall not apply in an emergency.
(2) This requirement shall not apply to vehicles parked in accordance with 9.7.2.3 and 9.7.2.4.

9.7.2.2* Vehicles shall not be parked in congested areas.

9.7.2.3 Where vehicles are parked off the street in uncongested areas, they shall be at least 50 ft (15 m) from any building used for assembly, institutional, or multiple residential occupancy.

9.7.2.4 Where vehicles carrying portable containers or cargo tank vehicles of 3500 gal (13 m^3) water capacity or less are parked on streets adjacent to the driver's residence in uncongested residential areas, the parking locations shall be at least 50 ft (15 m) from a building used for assembly, institutional, or multiple residential occupancy.

9.7.3 Parking Indoors.

9.7.3.1 Cargo tank vehicles parked in any public garage or building shall have LP-Gas liquid removed from the following:

(1) Cargo tank
(2) Piping
(3) Pump
(4) Meter
(5) Hose
(6) Related equipment

9.7.3.2 Vehicles used to carry portable containers shall not be moved into any public garage or building for parking until all portable containers have been removed from the vehicle.

9.7.3.3 The pressure in the delivery hose and related equipment shall be reduced to approximately atmospheric.

9.7.3.4 All valves shall be closed before the vehicle is moved indoors.

9.7.3.5 Delivery hose or valve outlets shall be plugged or capped before the vehicle is moved indoors.

9.7.3.6 Vehicles carrying or containing LP-Gas shall only be parked in buildings complying with Chapter 10 and located on premises owned or under the control of the operator of such vehicles where the following provisions are met:

(1) The public shall be excluded from such buildings.
(2) Floor level ventilation shall be provided in all parts of the building where such vehicles are parked.
(3) Leaks in the vehicle LP-Gas systems shall be repaired before the vehicle is moved indoors.
(4) Primary shutoff valves on cargo tanks and other LP-Gas containers on the vehicle (except propulsion engine fuel containers) shall be closed and delivery hose outlets shall be plugged or capped to contain system pressure before the vehicle is moved indoors.
(5) Primary shutoff valves on LP-Gas propulsion engine fuel containers shall be closed while the vehicle is parked.
(6) No LP-Gas container shall be located near a source of heat or within the direct path of hot air being blown from a blower-type heater.
(7) LP-Gas containers shall be gauged or weighed to determine that they are not filled beyond the maximum filling limit according to Section 7.4.

9.7.3.7 Where vehicles are serviced or repaired indoors, the following shall apply:

(1) When it is necessary to move a vehicle into any building located on premises owned or operated by the operator of such vehicle for service on engine or chassis, the provisions of 9.7.3.6 shall apply.
(2) When it is necessary to move a vehicle carrying or containing LP-Gas into any public garage or repair facility for service on the engine or chassis, the provisions of 9.7.3.1 shall apply, or the driver or a qualified representative of an LP-Gas operator shall be in attendance at all times while the vehicle is indoors, and the following shall apply:
   (a) Leaks in the vehicle LP-Gas systems shall be repaired before the vehicle is moved indoors.
   (b) Primary shutoff valves on cargo tanks, portable containers, and other LP-Gas containers installed on the vehicle (other than propulsion engine fuel containers) shall be closed.
   (c) LP-Gas liquid shall be removed from the piping, pump, meter, delivery hose, and related equipment and the pressure therein reduced to approximately atmospheric before the vehicle is moved inside.
   (d) Delivery hose or valve outlets shall be plugged or capped before the vehicle is moved indoors.
   (e) No container shall be located near a source of heat or within the direct path of hot air blown from a blower or from a blower-type heater.
   (f) LP-Gas containers shall be gauged or weighed to determine that they are not filled beyond the maximum filling capacity in accordance with Section 7.4.

9.7.3.8 If repair work or servicing is to be performed on a cargo tank vehicle system, all LP-Gas shall be removed from the cargo tank and piping, and the system shall be thoroughly purged before the vehicle is moved indoors.

Chapter 10 Buildings or Structures Housing LP-Gas Distribution Facilities

10.1 Scope.

10.1.1 Application. This chapter applies to the construction, ventilation, and heating of structures, parts of structures, and rooms housing LP-Gas systems where specified by other parts of the code.

10.1.2 Nonapplication. This chapter does not apply to buildings constructed or converted before December 31, 1972.

10.2 Separate Structures or Buildings.

10.2.1 Construction of Structures or Buildings.

10.2.1.1 Separate buildings or structures shall be one story in height and shall have walls, floors, ceilings, and roofs constructed of noncombustible materials.

Alliance for Uniform HazMat Transportation Procedures
Uniform Program Credentials

AMERIGAS PROPANE L P
PROPANE TRANSPORT INTERNATIONAL
PO BOX 965
VALLEY FORGE, PA 19482

ALLIANCE FOR UNIFORM HAZMAT TRANSPORTATION PROCEDURES

USDOT Census #	00388004	
MC Docket #	N/A	
EPA Transporter ID #	N/A	4847
Intrastate Motor Carrier #:	N/A	119565

Phone Number to call in case of a accident or emergency: 888-808-0396

Uniform Program ID:	UPM0388004OH		
Certified By:	Leonard Shenk		
Issuance Date:	26-Dec-2013	Expiration Date:	01-Jan-2015
Issuing Agency:	PUBLIC UTILITIES COMMISSION OF OHIO		
Agency Telephone:	(614) 466-3392		

THE PUBLIC UTILITIES COMMISSION OF OHIO

MATERIAL SAFETY DATA SHEET

PROPANE HD-5 ODORIZED

ENTERPRISE PRODUCTS OPERATING L.P.
P. O. BOX 4324
HOUSTON, TEXAS 77210

24 HOUR EMERGENCY ASSISTANCE
800-331-3032 or 713-803-8707
CHEMTREC 800-424-9300

I GENERAL

TRADE NAME	PROPANE HD-5 ODORIZED PROPANE
OTHER NAMES	LOW SULFUR, LOW-PROPYLENE, LOW-MOISTURE, LIQUEFIED PROPANE, DIMETHYL METHANE, SPECIAL MOTOR FUEL-GRADE PROPANE
CHEMICAL FAMILY	C3 - C8 HYDROCARBON
GENERIC NAME	C3 - C4 HYDROCARBONS, C3 RICH
CAS NO.	74—98—6

HAZARD RATING

LEAST 0> | SLIGHT 1> | MODERATE 2> | HIGH 3> | EXTREME 4

HEALTH	2
FIRE	4
REACTIVITY	0

DOT Hazardous Materials Proper Shipping Name
PROPANE OR LIQUIFIED PETROLEUM GAS

DOT Hazard Class
FLAMMABLE GAS

UN/IS No. UN 1075

II SUMMARY OF HAZARDS

EXTREMELY FLAMMABLE! OSHA/NFPA CLASS—1A FLAMMABLE GAS.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING! ASPHYXIANT HAZARD!
USE ONLY WITH ADEQUATE VENTILATION. ODOR IS AN INADEQUATE.
DO NOT DEPEND ON ODOR AS A WARNING OF DANGEROUS AIR CONCENTRATIONS.
MAY CAUSE FROSTBITE OR FREEZE BURNS!
AVOID EXPOSURE TO UQUID OR CYROGENIC GAS VAPOR
LOW BOILING POINT INTENSIFIES PRESSURE AND RAPID DIFFUSION HAZARD!

III FIRE AND EXPLOSION

Flash Point (Method)	Auto-ignition Temperature (Method)	Flammable Limits (% Vol. in air) At Normal Atmospheric Temperature and Pressure
—160 Deg. F. (AP)	AP 842 Deg. F. E-659 BASED UPON NFPA "PROPYLENE"	Lower 2.0 Upper 9.5 BASED UPON NFPA "PROPYLENE"

Fire and Explosion Hazards

THIS GAS RELEASES FLAMMABLE VAPORS AT WELL BELOW AMBIENT TEMPERATURES AND READILY FORMS FLAMMABLE MIXTURES WITH AIR. EXPOSED TO AN IGNITION SOURCE, IT WILL BURN IN THE OPEN OR BE EXPLOSIVE IN CONFINED SPACES. ITS VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL LONG DISTANCES TO A POINT OF IGNITION, AND THEN FLASH BACK TO SOURCE. ALKANE/CHLORINE GAS MIXTURES HAVE PRODUCED EXPLOSIONS.

Extinguishing Media

DRY CHEMICAL CO2
HALOGENATED EXTINGUISHING AGENT
WATER SPRAY (FOG) CAN BE USED TO DISSIPATE VAPORS
USE WATER SPRAY TO COOL ADJACENT EQUIPMENTAND STRUCTURES ADJACENT TO THE FIRE.

Special Firefighting Procedures

GAS FIRES SHOULD NOT BE EXTINGUISHED UNLESS THE GAS FLOW CAN BE STOPPED IMMEDIATELY. SHUT OFF GAS SOURCE AND ALLOW THE FIRE TO BURN ITSELF OUT. IF THE SOURCE CANNOT BE SHUT OFF IMMEDIATELY, ALL EQUIPMENT AND SURFACES EXPOSED TO THE FIRE SHOULD BE COOLED WITH WATER TO PREVENT OVER-HEATING, FLASHBACKS, OR EXPLOSIONS. CONTROL FIRE UNTIL GAS SUPPLY CAN BE SHUT OFF. FIREMEN MUST USE PROPER PROTECTIVE EQUIPMENT INCLUDING RESPIRATORY APPPRATUS TO PROTECT AGAINST HAZARDOUS COMBUSTION PRODUCTS/OXYGEN DEFICIENCIES.

PROPANE HD-5 ODORIZED

IV HEALTH HAZARDS

Summary of Acute Hazards	ASPHYXIATION. (SEE THE INHALATION' BOX BELOW.) FREEZE--BURNS

Route of Entry	SIGNS AND SYMPTOMS
Inhalation	EXPOSURE MAY PRODUCE RAPID BREATHING, HEADACHE, DIZZINESS, VISUAL DISTURBANCES, MUSCULAR WEAKNESS, TREMORS, NARCOSIS, UNCONSCIOUSNESS, AND DEATH, DEPENDING ON CONCENTRATION AND TIME OF EXPOSURE.
Eye Contact	THIS GAS IS NON—IRRITATING; BUT DIRECT CONTACT WITH LIQUEFIED/PRESSURIZED GAS OR FROST PARTICLES MAY PRODUCE SEVERE AND POSSIBLY PERMANENT EYE DAMAGE FROM FREEZE BURNS.
Skin Absorption	THIS MATERIAL IS NOT EXPECTED TO BE ABSORBED THROUGH THE SKIN BUT EXPOSURE MAY CAUSE FROSTBITE. SHORT TERM CONTACT MAY RESULT IN TISSUE DESTRUCTION AND SEVERE BURNS.
Skin Irritation	MAY CAUSE MILD SKIN IRRITATION. GAS & LIQUID FORMS OF THIS MATERIAL CAN CAUSE FROSTBITE OR FREEZE BURNS.
Ingestion	NOT EXPECTED TO BE AN INGESTION HAZARD. CONTACT WITH LIQUID CAN CAUSE FREEZE BURNS.
Summary of Chronic Hazards and Special Health Effects	INHALATION MAY PRODUCE MILD INTOXICATION, DROWSINESS, OR LOSS OF COORDINATION. HIGH CONCENTRATIONS PRODUCE INTOXICATION FOLLOWED BY LOSS OF CONSCIOUSNESS, ASPHYXIATION. AND DEATH. MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: PERSONNEL WITH PRE—EXISTING CENTRAL NERVOUS SYSTEM, HEART, LIVER, OR KIDNEY DISORDERS OR IMPAIRED PULMONONARY FUCTION SHOULD AVOID CONTACT WITH THIS MATERIAL. PERSONNEL WITH PRE—EXISTING CHRONIC RESPIRATORY DISEASES SHOULD REFRAIN FROM BREATHING THIS MATERIAL

V PROTECTIVE EQUIPMENT & CONTROL MEASURES

Respiratory	USE NIOSH/MSHA APPROVED RESPIRATORY PROTECTION EQUIPMENT, AIR PURIFYING WITH ORGANIC VAPOR CARTRIDGES AIR SUPPLIED IF OTHER PROTECTIVE MEASURES DO NOT ADEQUATELY CONTROL EXPOSURES. FOR EMERGENCIES AND UNKNOWN CONCENTRATIONS, USE POSITIVE PRESSURE SELF-CONTAINED BREATHING APPARATUS. UTILIZE RESPIRATORY PROTECTION EQUPMENT IN ACCORDANCE WITH 29 CFR 1910.134 (RESPIRATORY PROTECTION STANDARD).
Eye	USE CHEMICAL—TYPE GOGGLES AND FACE SHIELD WHEN HANDLING LIQUIFIED GASES. SAFETY GLASSES AND/OR FACE SHIELD ARE RECOMMENDED WHEN HANDLING HIGH—PRESSURE CYLENDERS AND PIPING SYSTEMS AND WHENEVER VAPORS ARE DISCHARGED.
Skin	PREVENT POTENTIAL SKIN CONTACT WITH COW LIQUIDS/VAPORS. USE INSULATED, IMPERVIOUS PLASTIC OR NEOPRENE—COATED CANVAS GLOVES AND PROTECTIVE GEAR (APRON, FACE SHIELD, ETC.) TO PROTECT HANDS AND OTHER SKIN AREAS.
Engineering Controls	LOCAL EXHAUST AND GENERAL ROOM VENTILATION MAY BOTH BE ESSENTIAL IN WORK AREAS TO PREVENT ACCUMULATON OF EXPLOSIVE MIXTURES. IF MECHANICAL VENTILATION IS USED, ELECTRICAL EQUIPMENT MUST MEET N.E.C. REQUIREMENTS.
Other Hygienic and Work Practices	EMERGENCY EYE WASH FOUNTAINS AND SAFETY SHOWERS FOR FIRST AID TREATMENT OF POTENTIAL FREEZE BURNS SHOULD BE AVAILABLE IN THE VICINITY OF ANY POTENTIAL EXPOSURE TO COMPRESSED GAS RELEASE. (ANSI 2358.1). (SEE SECTIONS IV. AND VII.) PERSONNEL SHOULD NOT ENTER AREAS WHERE THE ATMOSPHERE IS BELOW 19.5% VOL.% OXYGEN WITHOUT SPECIAL PROCEDURES/EQUIPMENT. RESPIRATOR USE SHOULD COMPLY WITH OSHA 29 CFR 1910.134 OR EQUIVALENT. AVOID SKIN CONTACT

VI OCCUPATIONAL EXPOSURE LIMITS

Substance	
ETHANE	N/A
PROPANE	8 HOUR TWA — 1000 PPM (NIOSH)
ISOBUTANE	N/A
ETHYL MERCAPTAN	0.5 PPM (NIOSH)

PROPANE HD-5 ODORIZED

Industrial Hygiene Comments	

VII EMERGENCY AND FIRST AID

Inhalation	IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR, FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER CPR (CARDIOPULMONARY RESUSCITATION). IF NECESSARY, OBTAIN MEDICAL ATTENTION IF BREATHING DIFFICULTIES CONTINUE. GET MEDICAL ATTENTION.
Eye Contact	VAPORS ARE NOT EXPECTED TO PRESENT AN EYE IRRITATION HAZARD. IF CONTACTED BY LIQUID/SOLID IMMEDIATELY FLUSH THE EYE(S) GENTLY WITH WARM WATER FOR AT LEAST 15 MINUTES. SEEK MEDICALATTENTION IF PAIN OR REDNESS PERSIST. GET MEDICAL ATTENTION.
Skin Contact	FROZEN TISSUES SHOULD BE FLOODED OR SOAKED WITH WARM WATER (105—115 Deg. F). DO NOT USE HOT WATER! CRYOGENIC BURNS WHCH RESULT IN BLISTERING OR DEEPER TISSUE FREEZING SHOULD BE PROMPTLY SEEN BY A PHYSICIAN.
Ingestion	NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION IMMEDIATELY.
Emergency Medical Treatment Procedures	SEE ABOVE PROCEDURES. PERSONNEL WITH PRE—EXISTING SKIN DISORDERS OR CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE TO THIS PRODUCT.

VIII SPILL AND DISPOSAL

Precautions if Material is pilled or released	ELIMINATE ALL POTENTIAL SOURCES OF IGNITION. EVACUATE ALL NON—ESSENTIAL PERSONNEL TO AN AREA UPWIND. (AT LEAST 1/2 MILE IN ALL DIRECTIONS IF TANKS OR TANK CARS ARE INVOLVED IN FIRE.) STOP SOURCE OF RELEASE WITH NON—SPARKING TOOLS BEFORE PUTTING OUT ANY FIRE. VENTILATE ENCLOSED AREAS TO PREVENT FORMATION OF FLAMMABLE OR OXYGEN—DEFICIENT ATMOSPHERES. WATER SPRAY MAY BE USED TO REDUCE VAPORS. CLOSED SYSTEMS FORM WHITE FROST THAT DO NOT READILY DISPERSE. AVOID VAPOR CLOUD EVEN WITH PROPER RESPIRATORY EQUIPMENT.
Waste Disposal Methods	RELEASES ARE EXPECTED TO CAUSE ONLY LOCALIZED NON— PERSISTENT ENVIRONMENTAL DAMAGE. WASTE MIXTURES CONTAINING THESE GASES SHOULD NOT BE ALLOWED TO ENTER DRAINS OR SEWERS WHERE THERE IS DANGER OF THEIR VAPORS BECOMING IGNITED. WHEN IT BECOMES NECESSARY TO DISPOSE OF THESE GASES, IT IS PREFERRABLE TO DO SO AS A VAPOR. UNUSED PRODUCT MAY BE USED AS AN AUXILLIARY FUEL OR DISPOSED BY BURNING IN A PROPERLY DESIGNED FLARE OR INCINERATOR. VENTING OF GAS TO THE ATMOSPHERE SHOULD BE AVOIDED. DEFECTIVE EMPTY, OR PARTIALLY USED PORTABLE CONTAINERS SHOULD BE RETURNED TO THE SUPPLIER WITH APPROPRIATE TAGS.

IX COMPONENTS

Component Name

This may not be a complete list of components

ETHANE	<6% MAX	PROPYLENE	<1.5%
PROPANE	90-95%	ISOBUTANE	<1.0%
ETHYL MERCAPTAN	<1%		

Normal concentraton ranges are shown, exceptions may occur.

X PHYSICAL AND CHEMICAL DATA

Boiling Point 760 mmHg: -44 Deg. F.	Viscosity Units, Temp. (Method) N/A	Dry Point N/A	
Freezing Point AP -305 Deg. F	Vapor Pressure mmHg @ 100 Deg. F: 190 psig/205psia	Volatile Characteristics 100%	
Speci. Gravity (H_2O = 1 at 39.2 Deg. F) AP 0.51	Vapor Sp. Gr. (Air = 1.0 at 60-90 Deg. F AP 1.5	Solubility In Water NEGLIGIBLE	pH N/A
Hazardous Polymerization NOT EXPECTED TO OCCUR	Other Chemical Reactivity EVAPORATION RATE (BuAc=1) Rapid	Stability STABLE	

Other Physical & Chemical Properties	GROSS HEAT OF COMBUSTION AT 60 Deg. F = 21,650 BTU/LB OR 2,550 BTU/3 LIQUEFIED GAS WHEN STORED UNDER ITS OWN VAPOR PRESSURE
Appearance and Odor	COLORLESS LIQUID UNDER PRESSURE. DISTINCTIVE ODOR DUE TO ADDED ETHYL MERCAPTAN.
Conditions to Avoid	EXPOSURE TO HEAT, SPARKS OR OPEN FLAMES
Materials to	STRONG OXIDIZERS, CHLORINE, FLUORINE AND FLUORINE COMPOUNDS. BROMINE AND METAL CATALYST

Avoid	
Hazardous Decomposition Products	COMBUSTION MAY PRODUCE CO, NOx, Sox, AND REACTIVE HYDROCARBONS

XI ADDITIONAL PRECAUTIONS

Handling, Storage and Decontamination Procedures	REFERTO APPLICABLE OSHA AND DOT REGULATIONS CONCERNING STORAGE. HANDLING, AND SHIPMENT OF PETROLEUM GASES. IF UPON INITIAL RECEIPT INSPECTION, A CYLINDER IS FOUND TO BE IN POOR OPERATING CONDITION. CONTACTTHE SUPPLIER THE MOST COMMON HAZARD IS LEAKAGE DUE TO FAULTY PRESSURE CONTROL REGULATORS. LARGE PRESSURE BUIW—UP CAN RESULT IN EXPLOSIVE DECOMPRESSION ATTHE CYLINDER HEAD. CAUSING THE CYLINDER TO ROCKET LIKE A MISSILE. USE PRESSURE—REDUCING REGULATORS WHEN CONNECTING TO LOWER PRESSURE PIRNG SYSTEMS. PREVENT ENTRAPMENT OF LIQUID IN CLOSED SYSTEMS. USE CHECK VALVE TO PREVENT BACK—FLOW INTO STORAGE CONTAINER. ALWAYS CHAIN CYLINDERS SECURELY IN AN UPRIGHT POSITION. STORE AND USE GAS CONTAINERS ONLY IN WELL VENTILATED AREAS. STORAGE AREAS SHOULD NOT EXCEED 100 DEg. F AND BE PROTECTED FROM DAMPNESS, SALT, OR CORROSIVE CHEMICALS. OSHIA REQUIRES CYUNDER STORAGE BE SEGREGATED FROM OXIDIZERS AND OTHER COMBUSTIBLE MATERIALS BY A DISTANCE OF AT LEAST 30 FEET.

XII REGULATORY INFORMATION

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III

SECTION 311/312 HAZARD CATEGORIES

IMMEDIATE (ACUTE) HEALTH HAZARD SUDDEN RELEASE OF PRESSURE

FIRE HAZARD

SECTION 313

NO CHEMICALS IN THIS PRODUCT EXCEED THE DE MINIMUS REPORTING LEVEL ESTABLISHED BY SARA TITLE III, SECTION 313 AND4O CFR 372.

PROPYLENE

TOXIC SUBSTANCES CONTROL ACT (TSCA)

ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE TSCA INVENTORY.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

NO CHEMICALS IN THIS PRODUCT ARE SUBJECT TO THE REPORTING REQUIREMENTS OF CERCLA

XIII SUPPLEMENT

Radioactivity Hazard	THE INFORMATION BELOW IS GIVEN TO CALL ATTENTION TO THE ISSUE OF "NATURALLY OCCURRING RADIOACTIVE MATERIALS'. ALTHOUGH RADON—222 LEVELS IN THE PRODUCT REPRESENTED BY THIS MSDS DO NOT PRESENT ANY DIRECT RADON EXPOSURE HAZARD, CUSTOMERS SHOULD BE AWARE OF THE POTENTIAL FOR RADON DAUGHTER BUILDUP WITHINTHEIR PROCESSING SYSTEMS, WHATEVER THE SOURCE OF THEIR PRODUCT STREAMS. RADON-222 IS A NATURALLY OCCURRING RADIOACTIVE GAS WHICH CAN BE A CONTAMINANT IN NATURALGAS. DURING SUBSEQUENT PROCESSING, RADON TENDS TO BE CONCENTRATED IN LIQUEFIED PETROLEUM GAS STREAMS AND IN PRODUCT STREAMS HAVING A SIMILAR BOILING POINT RANGE. INDUSTRY EXPERIENCE HAS SHOWN THAT THIS PRODUCT MAY CONTAIN SMALL AMOUNTS OF RADON—222 AND ITS RADIOACTIVE DECAY PRODUCTS. CALLED RADON "DAUGHTERS". THE ACTUAL CONCENTRATION OF RADON—222 AND RADIOACTIVE DAUGHTERS IN THE DELIVERED PRODUCT IS DEPENDENT ON THE GEOGRAPHICAL SOURCE OF THE NATURAL GAS AND STORAGE TIME PRIOR TO DELIVERY. PROCESS EQUIPMENT (I.E., LINES, FILTERS. PUMPS AND REACTION UNITS) MAY ACCUMULATE SIGNIFICANT LEVELS OF RADIOACTIVE DAUGHTERS AND SHOW A GAMMA RADIATION READING DURING OPERATION. A POTENTIAL EXTERNAL RADIATION HAZARD EXISTS AT OR NEAR ANY PIPE VALVE. OR VESSEL CONTAINING A RADON—ENRICHED STREAM, OR CONTAINING INTERNAL DEPOSITS OF RADIOACTIVE MATERIAL DUE TO THE TRANSMISSION OF GAMMA RADIATION THROUGH ITS WALL. FIELD STUDIES REPORTED IN THE LITERATURE AND CONDUCTED BY COMPANY PERSONNEL AT SELECTED SITES, HAVE NOT SHOWN ANY CONDITIONS THAT SUBJECT WORKERS TO CUMULATIVE EXPOSURES IN EXCESS OF GENERAL POPULATION LIMITS. EQUIPMENT EMITTING GAMMA RADIATION SHOULD BE PRESUMED TO BE INTERNALLY CONTAMINATED WITH ALPHA—EMITTING DECAY PRODUCTS WHICH MAY BE A HAZARD IF INHALED OR INGESTED. DURING MAINTENANCE OPERATION THAT REQUIRE THE OPENING OF CONTAMINATED PROCESS EQUIPMENT, THE FLOW OF GAS SHOULD BE STOPPED AND A FOUR HOUR DELAY ENFORCED TO ALLOW THE GAMMA RADIATION TO DROP TO BACKGROUND LEVELS. PROTECTIVE EQUIPMENT SUCH AS COVERALLS. GLOVES, AND RESPIRATOR (NIOSH/MSHA—APPROVED FOR HIGH EFFICIENCY PARTICULATES AND AND RADIONUCLIDES, OR SUPPLIED AIR) SHOULD BE WORN BY PERSONNEL ENTERING A VESSEL OR WORKING ON CONTAMINATED PROCESS EQUIPMENTTO PREVENT SKIN CONTAMINATION, INGESTION, OR INHALATION OF ANY RESIDUES CONTAINING ALPHA RADIATION. AIRBORNE CONTAMINATION MAY BE MINIMIZED BY HANDLING SCALE AND/OR CONTAMINATED MATERIALS IN A WET STATE.

The information contained in this Material Safety Data Sheet relates only to the specific chemical designated herein and may not be valid for such chemical used in combination with any other chemical or mixture, or in any particular process. The best of this Company's knowledge, the information contained herein is accurate as of the date of preparation; however, NO REPRESENTATION, GUARANTEE OR WARRANTY IS MADE AS TO ITS

FOR ADDITIONAL INFORMATION OR IN CASE OF AN ACCIDENT INVOLVING BODILY INJURY OR PROPERTY DAMAGE

ACCURACY, RELIABILITY OR COMPLETENESS. It is the user's responsibility to satisfy itself of the suitability of such information for the user's particular purpose.

IMMEDIATELY NOTIFY THE CORPORATE CLAIMS DEPARTMENT

* During Regular working hours: 7:30 a.m. to 4:00 p.m. Monday through Thursday; 7:30 to 12:30 Friday, contact the Corporate Claims Department at (713) 880-6650, (713) 880-6673, (713) 880-6500. At this time give them full particulars and stand by for further instructions.

* Before and after regular working hours, and/or weekends or holidays, contact the 24 hour Seminole Control Center Office at 1-800-331-3032. In Houston area 713-803-8707.

CALL CHEMTREC 1-800-424-9300

FOR FURTHER ASSISTANCE IF HAZARDOUS MATERIALS ARE INVOLVED.

6. COMPANY BACKGROUND AND REFERENCES

6.1 VENDOR INFORMATION

6.1.1 Vendors must provide a company profile in the table format below.

Question	Response
Company name:	AmeriGas Propane L.P.
Ownership (sole proprietor, partnership, etc.):	Limited Partnership
State of incorporation:	Delaware
Date of incorporation:	4/15/1959
# of years in business:	55
List of top officers:	See attached list
Location of company headquarters:	King of Prussia, PA
Location(s) of the company offices:	
Location(s) of the office that will provide the services described in this RFQ:	See attached list of offices
Number of employees locally with the expertise to support the requirements identified in this RFQ:	47
Number of employees nationally with the expertise to support the requirements in this RFQ:	N/A
Location(s) from which employees will be assigned for this project:	See attached list of servicing offices

6.1.2 **Please be advised**, pursuant to NRS 80.010, a corporation organized pursuant to the laws of another state must register with the State of Nevada, Secretary of State's Office as a foreign corporation before a contract can be executed between the State of Nevada and the awarded vendor, unless specifically exempted by NRS 80.015.

6.1.3 The selected vendor, prior to doing business in the State of Nevada, must be appropriately licensed by the State of Nevada, Secretary of State's Office pursuant to NRS76. Information regarding the Nevada Business License can be located at http://sos.state.nv.us.

Question	Response
Nevada Business License Number:	NV19951024549
Legal Entity Name:	AmeriGas Propane, L.P.

Is "Legal Entity Name" the same name as vendor is doing business as?

Yes	✓	No	

If "No", provide explanation.

6.1.4 Vendors are cautioned that some services may contain licensing requirement(s). Vendors shall be proactive in verification of these requirements prior to proposal

Partnership Information

Investor Services

Transfer Agent and Registrar

Unitholder communications regarding transfer of units, lost certificates, lost distribution checks or changes of address should be directed to:

By Mail:
Computershare Investor Services
P.O. Box 43078
Providence, RI 02940-3078

By Overnight Delivery:
Computershare Investor Services
250 Royall Street
Canton, MA 02021

800-254-5196 (U.S. and Canada)
312-360-5100 (other countries)

Unitholders can also view real-time account information and request transfer agent services online at the Computershare Investor Services website: www.computershare.com/investor. Computershare Investor Services can be accessed through telecommunications devices for the hearing impaired by calling:
800-822-2794 (U.S. and Canada) 312-588-4110 (other countries)

Investor Relations

Securities analysts, portfolio managers and other members of the professional investment community should direct inquiries about the Partnership to:
Treasurer
AmeriGas Propane, Inc.
P.O. Box 965
Valley Forge, PA 19482
610-337-7000

News, Earnings, Financial Reports and Governance Documents

Comprehensive news, webcast events and other information about AmeriGas Partners, L.P. and UGI Corporation are available via the internet at: www.amerigas.com.

You can also request reports filed with the SEC and corporate governance documents, including the General Partner's Codes of Ethics and Principles of Corporate Governance, free of charge, by writing to, Treasurer at the address above.

Tax Information

AmeriGas Partners, L.P. is a publicly traded master limited partnership. All unitholders are limited partners eligible to receive cash distributions.

A partnership has different tax implications for its owners than a corporation has for its shareholders. The annual income, gains, losses, deductions or credits of a partnership flow through to its unitholders, or limited partners, who are required to report their allocated share of these amounts on their own income tax returns.

By March 15, 2014, tax information in the form of a Schedule K-1, which will summarize each unitholder's allocated share of the Partnership's reportable tax items for the calendar year ended December 31, 2013, will be mailed to each unitholder of AmeriGas Partners, L.P. The Schedule K-1 will also be available via the internet by accessing the Investor Relations section at www.amerigas.com.

For additional information regarding taxes, unitholders should consult with their personal tax adviser. AmeriGas Tax Information Services, at 800-310-9145, is available for questions regarding the Schedule K-1.

Board of Directors

Lon R. Greenberg [2]
Chairman

John L. Walsh [2]
Vice Chairman

Jerry E. Sheridan
President and Chief Executive Officer

Brian R. Ford [1,4]
Retired partner of Ernst & Young LLP

William J. Marrazzo [1,2,3]
Chief Executive Officer and President, WHYY, Inc.

Anne Pol [3,4]
Retired President and Chief Operating Officer, Trex Enterprises Corporation

Howard B. Stoeckel [1,4]
Vice Chairman and Retired Chief Executive Officer, Wawa, Inc.

Marvin O. Schlanger (Presiding Director) [2,3,4]
Principal, Cherry Hill Chemical Investments, LLC

K. Rick Turner [1]
Retired private equity principal of the Stephens Group, LLC

[1] Audit Committee
[2] Executive Committee
[3] Compensation/Pension Committee
[4] Corporate Governance Committee

Officers

John L. Walsh, Vice Chairman

Jerry E. Sheridan, President and Chief Executive Officer

Robert J. Cane, Controller and Chief Accounting Officer

Troy E. Fee, Vice President – Human Resources

Hugh J. Gallagher, Vice President – Finance and Chief Financial Officer, Treasurer

Monica M. Gaudiosi, Vice President and Secretary

R. Paul Grady, Vice President and Chief Operating Officer

James C. Hamilton, II, Vice President, Southern Region

Stephen Lee, Vice President – Strategic Initiatives & Marketing

David L. Lugar, Vice President – Supply and Logistics

James Marshall, Vice President, Central Region

James L. Palkovic, Vice President, Western Region

Warren J. Patterson, Vice President – National Accounts

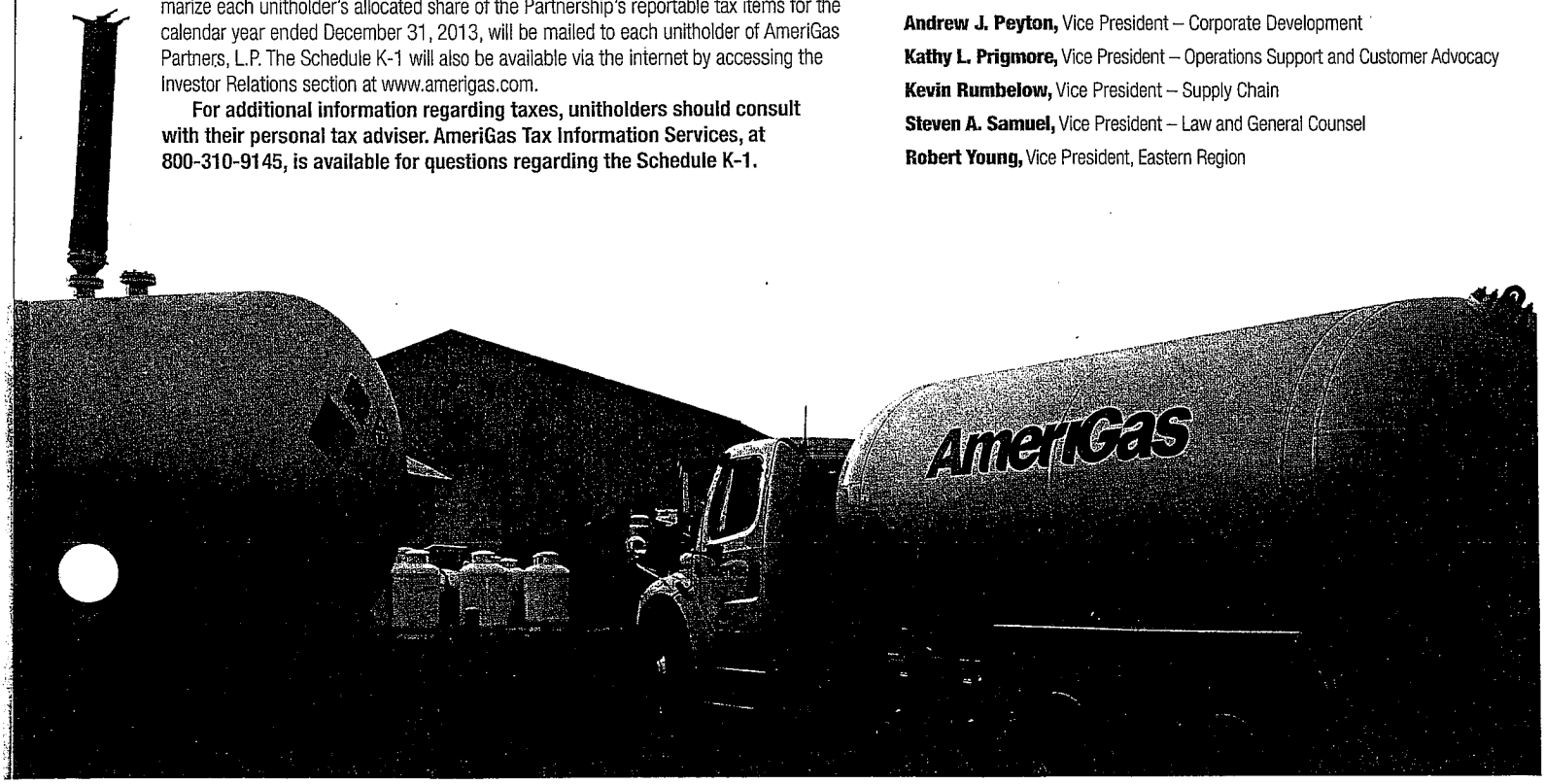
Andrew J. Peyton, Vice President – Corporate Development

Kathy L. Prigmore, Vice President – Operations Support and Customer Advocacy

Kevin Rumbelow, Vice President – Supply Chain

Steven A. Samuel, Vice President – Law and General Counsel

Robert Young, Vice President, Eastern Region



AmeriGas Offices Servicing Nevada

District Name	DBA	ShipAddr	ShipCity	St	ShipZip	Phone
S. Lake Tahoe CA	Bi-State Propane	2070 JAMES AVE #A	S LAKE TAHOE	CA	96150	(530) 541-3320
Carson City NV	AmeriGas	4501 GONI RD	CARSON CITY	NV	89706	(775) 882-2191
Winnemucca NV	AmeriGas	3400 W WINNEMUCCA BLVD	WINNEMUCCA	NV	89445	(775) 623-5055
Hawthorne NV	AmeriGas	1118 EAST FIFTH ST	HAWTHORNE	NV	89415	(775) 945-3335
Tonopah NV	AmeriGas	410 CUTTING ST	TONOPAH	NV	89049	(775) 482-3303
Spring Creek NV	AmeriGas	150 LANDMARK LN	SPRING CREEK	NV	89815	(775) 778-9444
Fallon NV	AmeriGas	4490 RENO HWY	FALLON	NV	89406	(775) 423-3632
Sparks NV	Bi-State Propane	1410 GREG ST, #401-403A	SPARKS	NV	89431	(775) 331-3100
Yerington NV	Bi-State Propane	20 HIGHWAY 95A NORTH	YERINGTON	NV	89447	(775) 463-2363
Gardnerville NV	BI-State Propane	1267 HWY 395 NO, STE E	GARDNERVILLE	NV	89410	(775) 782-2371
Las Vegas NV	AmeriGas	4420 MCGUIRE ST	N LAS VEGAS	NV	89081	(702) 642-3354
Pahrump NV	AmeriGas	31 E WILSON RD	PAHRUMP	NV	89048	(775) 727-4238
Cedar City UT	AmeriGas	2865 WEST HWY 56	CEDAR CITY	UT	84720	(435) 586-6731
HP-Kingman AZ (412)	NORTHERN ENERGY	2625 AIRWAY AVE	KINGMAN	AZ	86409	(928) 757-7923

submittal. Proposals that do not contain the requisite licensure may be deemed non-responsive.

6.1.5 Has the vendor ever been engaged under contract by any State of Nevada agency?

Yes		No	✓

If "Yes", complete the following table for each State agency for whom the work was performed. Table can be duplicated for each contract being identified.

Question	Response
Name of State agency:	N/A
State agency contact name:	
Dates when services were performed:	
Type of duties performed:	
Total dollar value of the contract:	

6.1.6 Are you now or have you been within the last two (2) years an employee of the State of Nevada, or any of its agencies, departments, or divisions?

Yes		No	✓

If "Yes", please explain when the employee is planning to render services, while on annual leave, compensatory time, or on their own time?

If you employ (a) any person who is a current employee of an agency of the State of Nevada, or (b) any person who has been an employee of an agency of the State of Nevada within the past two (2) years, and if such person will be performing or producing the services which you will be contracted to provide under this contract, you must disclose the identity of each such person in your response to this RFQ, and specify the services that each person will be expected to perform.

6.1.7 Disclosure of any significant prior or ongoing contract failures, contract breaches, civil or criminal litigation in which the vendor has been alleged to be liable or held liable in a matter involving a contract with the State of Nevada or any other governmental entity. Any pending claim or litigation occurring within the past six (6) years which may adversely affect the vendor's ability to perform or fulfill its obligations if a contract is awarded as a result of this RFQ must also be disclosed. Does any of the above apply to your company?

Yes		No	✓

If "Yes", please provide the following information. Table can be duplicated for each issue being identified.

Question	Response
Date of alleged contract failure or	N/A

Question	Response	
breach:	N/A	
Parties involved:		
Description of the contract failure, contract breach, or litigation, including the products or services involved:		
Amount in controversy:		
Resolution or current status of the dispute:		
If the matter has resulted in a court case:	Court	Case Number
Status of the litigation:		

6.1.8 Vendors must review the insurance requirements specified in ***Attachment E, Insurance Schedule for RFQ 3064.*** Does your organization currently have or will your organization be able to provide the insurance requirements as specified in ***Attachment E.***

Yes	✓	No	

Any exceptions and/or assumptions to the insurance requirements ***must*** be identified on ***Attachment B, Technical Proposal Certification of Compliance with Terms and Conditions of RFP.*** Exceptions and/or assumptions will be taken into consideration as part of the evaluation process; however, vendors must be specific. If vendors do not specify any exceptions and/or assumptions at time of proposal submission, the State will not consider any additional exceptions and/or assumptions during negotiations.

Upon contract award, the successful vendor ***must*** provide the Certificate of Insurance identifying the coverages as specified in ***Attachment E, Insurance Schedule for RFP 3064.***

6.1.9 Company background/history and why vendor is qualified to provide the services described in this RFQ. Limit response to no more than five (5) pages.

6.1.10 Length of time vendor has been providing services described in this RFQ to the public and/or private sector. Please provide a brief description.

6.1.11 Financial information and documentation to be included in Part III, Confidential Financial of vendor's response in accordance with ***Section 12.4, Part II – Confidential Financial.***

6.1.11.1 Dun and Bradstreet Number 835406539

6.1.11.2 Federal Tax Identification Number 232787917

6.2 SUBCONTRACTOR INFORMATION

6.2.1 Does this proposal include the use of subcontractors, excluding the use of common carriers registered with a valid SCAC?

Yes		No	✓

If "Yes", vendor must:

6.2.1.1 Identify specific subcontractors and the specific requirements of this RFQ for which each proposed subcontractor will perform services.

6.2.1.2 If any tasks are to be completed by subcontractor(s), vendors must:

A. Describe the relevant contractual arrangements;

B. Describe how the work of any subcontractor(s) will be supervised, channels of communication will be maintained and compliance with contract terms assured; and

C. Describe your previous experience with subcontractor(s).

6.2.1.3 Vendors must describe the methodology, processes and tools utilized for:

A. Selecting and qualifying appropriate subcontractors for the project/contract;

B. Ensuring subcontractor compliance with the overall performance objectives for the project;

C. Ensuring that subcontractor deliverables meet the quality objectives of the project/contract; and

D. Providing proof of payment to any subcontractor(s) used for this project/contract, if requested by the State. Proposal should include a plan by which, at the State's request, the State will be notified of such payments.

6.2.1.4 Provide the same information for any proposed subcontractors as requested in ***Section 6.1, Vendor Information***.

6.2.1.5 Business references as specified in ***Section 6.3, Business References*** must be provided for any proposed subcontractors.

6.2.1.6 Vendor shall not allow any subcontractor to commence work until all insurance required of the subcontractor is provided to the vendor.

6.2.1.7 Vendor must notify the using agency of the intended use of any subcontractors not identified within their original proposal and provide

the information originally requested in the RFQ in ***Section 6.2, Subcontractor Information***. The vendor must receive agency approval prior to subcontractor commencing work.

6.3 BUSINESS REFERENCES

6.3.1 Vendors should provide a minimum of three (3) business references from similar projects performed for private, state and/or large local government clients within the last three (3) years.

6.3.2 Vendors must provide the following information for ***every*** business reference provided by the vendor and/or subcontractor:

The "Company Name" must be the name of the proposing vendor or the vendor's proposed subcontractor.

Reference #: 1			
Company Name:	Commonwealth of Kentucky		
Identify role company will have for this RFQ project (check one):			
	VENDOR		***SUBCONTRACTOR***
Project Name:	Bulk and Tank Propane		
Primary Contact Information			
Name:	Don Robinson		
Street Address:	Procurement Services Rm 096 Capitol Annex		
City, State, Zip	Frankfort, KY 40601		
Phone, including area code:	502-564-6525		
Facsimile, including area code:	502-564-1434		
Email address:	DonE.Robinson@ky.gov		
Alternate Contact Information			
Name:			
Street Address:			
City, State, Zip			
Phone, including area code:			
Facsimile, including area code:			
Email address:			

6.3.3 Vendors must also submit ***Attachment F, Reference Questionnaire*** to the business references that are identified in ***Section 6.3.2***.

6.3.4 The company identified as the business references must submit the Reference Questionnaire directly to the Purchasing Division.

the information originally requested in the RFQ in ***Section 6.2, Subcontractor Information***. The vendor must receive agency approval prior to subcontractor commencing work.

6.3 BUSINESS REFERENCES

6.3.1 Vendors should provide a minimum of three (3) business references from similar projects performed for private, state and/or large local government clients within the last three (3) years.

6.3.2 Vendors must provide the following information for ***every*** business reference provided by the vendor and/or subcontractor:

The "Company Name" must be the name of the proposing vendor or the vendor's proposed subcontractor.

Reference #: 2			
Company Name:	State of Connecticut		
Identify role company will have for this RFQ project (check one):			
	VENDOR		***SUBCONTRACTOR***
Project Name:	Propane Services		
Primary Contact Information			
Name:	Paul Greco		
Street Address:	165 Capitol Ave, 5th Fl South		
City, State, Zip	Hartford, CT 06106-1659		
Phone, including area code:	860-713-5189		
Facsimile, including area code:			
Email address:	paul.greco@ct.gov		
Alternate Contact Information			
Name:			
Street Address:			
City, State, Zip			
Phone, including area code:			
Facsimile, including area code:			
Email address:			

6.3.3 Vendors must also submit ***Attachment F, Reference Questionnaire*** to the business references that are identified in ***Section 6.3.2***.

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6.3.2 Vendors must provide the following information for ***every*** business reference provided by the vendor and/or subcontractor:

The "Company Name" must be the name of the proposing vendor or the vendor's proposed subcontractor.

Reference #: 3	
Company Name:	State of Washington
Identify role company will have for this RFQ project (check one):	
VENDOR	***SUBCONTRACTOR***
Project Name:	Propane Gas and Services
Primary Contact Information	
Name:	Keith Farley
Street Address:	1500 Jefferson St
City, State, Zip	Olympia WA 98504
Phone, including area code:	360-403-9419
Facsimile, including area code:	
Email address:	kfarley@ga.wa.gov
Alternate Contact Information	
Name:	Customer Service
Street Address:	
City, State, Zip	
Phone, including area code:	360-902-7400
Facsimile, including area code:	
Email address:	

6.3.3 Vendors must also submit ***Attachment F, Reference Questionnaire*** to the business references that are identified in ***Section 6.3.2***.

6.3.4 The company identified as the business references must submit the Reference Questionnaire directly to the Purchasing Division.

State of Nevada
Department of Administration
Purchasing Division
515 E. Musser Street, Suite 300
Carson City, NV 89701

Brian Sandoval
Governor

Greg Smith
Administrator

SUBJECT:	Amendment 1 to Request for Qualification 3064
RFP TITLE:	Bulk Fuel Purchase and Delivery Service
DATE OF AMENDMENT:	September 19, 2013
DATE OF RFP RELEASE:	August 19, 2013
OPENING DATE:	October 9, 2013
OPENING TIME:	2:00 PM
CONTACT:	Nancy Feser, Procurement Staff Member

The following shall be a part of RFQ ***3064.*** If a vendor has already returned a proposal and any of the information provided below changes that proposal, please submit the changes along with this amendment. You need not re-submit an entire proposal prior to the opening date and time.

Revisions to RFQ:

Section 1 of the RFQ is being revised to read:

> The State does not guarantee any minimum number of bulk fuel purchases under this contract. As these contracts will affect several State agencies, the approximate number of bulk fuel purchases, using agencies, etc. is unavailable.
>
> The State reserves the right to accept vendor proposals for qualification on an ongoing basis. Any future contract awards will be written based upon termination dates concurrent with contracts awarded as a result of the original RFQ.

Questions and Answers to RFQ:

1. Can you do better than 30 days for payment terms, i.e. Net 10 or Net 15?

   Payments for invoices will be made within 10-15 days of receipt; refer to Section 8 of the RFQ.

2. Have any addendums been released for this bid?

   No, this is the first amendment/addendum to this RFQ.

3. Do you currently receive a discount for prompt payment of invoices?

The State receives prompt payment discounts on various purchases and is willing to consider prompt pay discount offered.

4. Can we please have a list of bidders invited to submit a proposal?

   This information is not available.

5. Will a metered bill of lading be acceptable in place of the metered truck requirement?

   Yes.

6. Do you consider common carriers to be subcontractors?

   Yes.

7. Is this RFQ a pre-qualification of suppliers and no pricing is due by 10/9/2013?

   Correct, the purpose of this RFQ is to determine the qualifications of vendors per the Minimum Qualifications in Section 3.2 of the RFQ. As needed, agencies will then make purchases, from the qualified vendors awarded contracts with consideration of lowest cost and availability of fuel delivery, at time of purchase.

   If yes to question above, when is the official RFP estimated to release?

   Refer to Question 7 above.

8. Who are the current suppliers?

   Below is a list of fuel vendors that have been used by individual agencies; however, these vendor's are not under contract.

   Suburban Propane, Gale Oil and Tire, Sage Petroleum Products, Western Entergenix, Flyers Energy LLC, Carson Valley Oil, Al Park Petroleum, Thomas Petroleum, Turner Petroleum, Chris's Service, Rebel Oil, and Epic Aviation.

9. Is ACH payment method acceptable?

   Yes.

10. What is the pricing index and terminal cities preferred?

    The State is not incorporating the pricing index into this RFQ, and there is no preference regarding which terminals are used by the Vendors.

11. Metered tickets on full tanker transports is not commercial standard. Please confirm if the refiners temperature corrected bill of lading will be acceptable?

    Yes, the refiners temperature corrected bill of lading is acceptable.

12. During the pre-proposal conference, it was brought to the States attention that the following propane tanks are owned by Suburban Propane:

Tonopah Conservation Camp	***6 – 1,150 gallon tanks***
Glendale NDOT	***1- 500 gallon tank***
Indian Springs NDOT	***1 – size of tank unspecified***
Mt. Charles NDOT	***1 – 1,000 gallon tank***
Searchlight NDOT	***1 – 500 gallon tank***

ALL ELSE REMAINS THE SAME FOR RFQ 3064.

Vendor must sign and return this amendment with proposal submitted.

Vendor Name: AmeriGas Propane, L.P.

Authorized Signature: [signature]

Title: V.P. Date: 9/15/14

This document must be submitted in the "State Documents" section/tab of vendors' technical proposal.