

NFPA® 59

Utility LP-Gas Plant Code

2018



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NFPA® 59

Utility LP-Gas Plant Code

2018 Edition

This edition of NFPA 59, *Utility LP-Gas Plant Code*, was prepared by the Technical Committee on LP-Gases at Utility Gas Plants and acted on by NFPA at its June Association Technical Meeting held June 4–7, 2017, in Boston, MA. It was issued by the Standards Council on August 17, 2017, with an effective date of September 6, 2017, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See “Codes & Standards” at www.nfpa.org for more information.

This edition of NFPA 59 was approved as an American National Standard on September 6, 2017.

Origin and Development of NFPA 59

NFPA 58, *Standard on Liquefied Petroleum Gases*, was applied to utility gas plants to the degree it covered them until NFPA 59 was adopted in 1949. Subsequent editions were adopted in 1954, 1956, 1958, 1962, 1963, 1968, 1974, 1976, 1979, 1984, 1989, 1992, 1995, 1998, 2001, 2004, 2008, 2012, and 2015.

The first edition of NFPA 59 resulted from the formation of a special committee under the sponsorship of the American Gas Association (AGA), which was made up of utility engineers, specialists in gas plant construction, and engineers in the liquefied petroleum gas industry. The standard was initially the result of the AGA Committee’s acting in an advisory capacity to the Sectional Committee on Utility Gas of the NFPA Committee on Gases.

With the formation in 1966 of the Committee on Fuel Gases, NFPA 59 was assigned to that committee and then to a new Subcommittee on Utility Gas Plants. In 1972, responsibility for NFPA 59 was reassigned to the Committee on Liquefied Petroleum Gases, which retained the Subcommittee on Utility Gas Plants.

In 1992, the subcommittee was discharged, and NFPA 59 was assigned to the Technical Committee on LP-Gases at Utility Gas Plants. The committee maintains correlation with NFPA 58 by overlapping committee membership and concurrent or joint meetings.

Changes in the 2004 edition included reorganization of the document to conform to the *Manual of Style for NFPA Technical Committee Documents*.

For the 2008 edition, the committee expanded extracts from NFPA 58 where the coverage was similar to provide users of NFPA 59 a more complete document. Many requirements of the code were clarified, and the organization of the document was simplified.

For the 2012 edition, a new section on corrosion protection was added that largely extracted existing requirements from 49 CFR 193. Those requirements were included in NFPA 59 to increase awareness of corrosion control requirements and to align requirements among similar types of gas process facilities. The committee also added a new section on training of personnel engaged in the maintenance or operation of propane–air mixing equipment. In addition, the 2012 edition included a new section on construction and modification records that required operators to maintain records of the materials of construction for process equipment piping systems containing LP-Gas and other flammable fluids, including their supporting system and foundations for plants that were built or modified after the effective date of the 2012 edition. The requirements for separation distances for containers less than 2000 gal (7.6 m³) were extracted from NFPA 58 because more plants covered under the scope of NFPA 59 were using these smaller containers. The requirement for vent stacks on nonrefrigerated aboveground containers was removed because studies showed that the dispersion of discharged vapor was not a safety issue.

In the 2015 edition, the scope in 1.1.1 was clarified to identify the demarcation between NFPA 59 and applicable pipeline regulations published by the Department of Transportation (DOT). Building

ventilation requirements in Chapter 8 were expanded to specify the purpose and activation of the ventilation system. In addition, Chapter 9 was restructured for clarity and a new subsection was created to consolidate requirements for gas-fired vaporizers. The sizing method for nonrefrigerated container relief devices in Section 10.2 was modified for propane storage over 300 psi and butane storage over 250 psi to provide more accurate sizing for higher pressure and butane containment.

Finally, the corrosion protection requirements in Section 12.3 was expanded to reflect current DOT regulations and common practices. The requirements for Chapter 12 were retroactive to all facilities, and a schedule for retroactivity of corrosion control requirements was added in 12.3.8.

For the 2018 edition, the technical committee has added a purpose statement. Various extracts have been updated, and vehicular fuel operations have been removed because it has been determined that vehicular fuel operations are outside the scope of this code. For those containers taken out of service for a year, the *National Board Inspection Code* is to be used to determine the suitability of placing it back into service. Chapter 6, the refrigerated container chapter, has been updated to reflect current industry practices and external standard development. The committee also determined that instead of protecting only outside piping from physical damage and corrosion, all piping must be protected.

In addition, it has been determined that it is no longer appropriate to utilize operating malfunctions to detect leaks. Installation of corrosion protection has been moved from Chapter 12 to Chapter 4. New definitions for *component*, *facility*, *plant*, and *process pressure vessel* have been added, and several sections have been added or revised to reflect these new definitions. New piping cover requirements have been added to Chapter 7. Table 4.5.2.2 has been revised to match the 1998 version of this code for relief valve discharge electrical area classification.

Finally, clarification has been added for fire protection systems citing additional existing NFPA standards, and the term *fire control* has been replaced with *fire protection*.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the design, construction, location, installation, operation, and maintenance of refrigerated and nonrefrigerated liquefied petroleum gas plants to the point of introduction into the utility gas distribution system or those plants that are subject to the requirements of Title 49, Code of Federal Regulations, Part 192, Pipeline Safety Law, issued pursuant to the laws in 49 U.S.C. et seq.

Contents

Chapter 1 Administration	59- 6	7.8 Pumps and Compressors in Refrigerated LP-Gas Systems.	59- 25
1.1 Scope.	59- 6	7.9 Process Pressure Vessels.	59- 25
1.2 Purpose.	59- 6	7.10 Protection of Container Accessories.	59- 25
1.3 Nonapplication of Code.	59- 6	7.11 Transfer Equipment.	59- 25
1.4 Retroactivity.	59- 6		
1.5 Equivalency.	59- 6	Chapter 8 Buildings or Structures Housing LP-Gas Distribution Facilities	59- 26
1.6 Enforcement.	59- 6	8.1 Scope.	59- 26
1.7 Pressure Measurement.	59- 7	8.2 Separate Structures or Buildings.	59- 26
Chapter 2 Referenced Publications	59- 7	8.3 Attached Structures or Rooms Within Structures.	59- 26
2.1 General.	59- 7	8.4 Rooms Housing Vaporizers or Mixers.	59- 27
2.2 NFPA Publications.	59- 7		
2.3 Other Publications.	59- 7	Chapter 9 Vaporizers, Heat Exchangers, and Gas-Air Mixers	59- 27
2.4 References for Extracts in Mandatory Sections. ...	59- 8	9.1 General.	59- 27
Chapter 3 Definitions	59- 8	9.2 Buildings or Rooms Housing Vaporizers or Gas-Air Mixers.	59- 27
3.1 General.	59- 8	9.3 Vaporizers.	59- 27
3.2 NFPA Official Definitions.	59- 8	9.4 Gas-Air Mixers.	59- 27
3.3 General Definitions.	59- 8	9.5 Vaporizer Installation.	59- 28
Chapter 4 General Requirements	59- 10	Chapter 10 Relief Devices	59- 29
4.1 Personnel Training.	59- 10	10.1 General.	59- 29
4.2 Odorizing Gases.	59- 10	10.2 Nonrefrigerated Container Relief Devices.	59- 29
4.3 Acceptance of Equipment.	59- 10	10.3 Refrigerated Container Relief Devices.	59- 31
4.4 Damage from Vehicles.	59- 10	10.4 Relief Device Sizing for Refrigerated Containers.	59- 31
4.5 Ignition Source Control.	59- 10	10.5 Refrigerated Container Relief Device Sizing for Fire Exposure.	59- 32
4.6 Lighting.	59- 10	10.6 Pressure Relief Valve Discharge Vents.	59- 32
4.7 Construction and Modification Records.	59- 12	10.7 Vaporizers.	59- 33
4.8 Design and Installation.	59- 12	10.8 Hydrostatic Relief Valves.	59- 33
4.9 Atmospheric Corrosion Control.	59- 13		
4.10 External Corrosion Control: Buried or Submerged Components.	59- 13	Chapter 11 Operations	59- 33
4.11 Internal Corrosion Control.	59- 13	11.1 General.	59- 33
4.12 Interference Currents.	59- 13	11.2 Operating Procedures Manuals.	59- 33
Chapter 5 Nonrefrigerated Containers	59- 14	11.3 Handling.	59- 33
5.1 Provision for Construction and Original Test of Nonrefrigerated Containers.	59- 14	11.4 Operating Records.	59- 34
5.2 Design Pressure and Classification of Nonrefrigerated Containers.	59- 14	Chapter 12 Maintenance	59- 34
5.3 ASME Container Markings.	59- 14	12.1 Retroactivity.	59- 34
5.4 Location of Nonrefrigerated Containers.	59- 14	12.2 Maintenance Manuals.	59- 34
5.5 Installation of Nonrefrigerated Storage Containers.	59- 15	12.3 Corrosion Protection.	59- 34
5.6 Reinstallation of Nonrefrigerated Containers.	59- 16	12.4 Maintenance of Emergency Shutoff and Check Valves.	59- 35
5.7 Filling Densities.	59- 16	12.5 Maintenance of Foundations and Supports.	59- 35
5.8 Point of Transfer Spacing.	59- 17	12.6 Maintenance of Fire Protection Equipment.	59- 35
Chapter 6 Refrigerated Containers	59- 17	12.7 Leakage Surveys.	59- 36
6.1 Scope.	59- 17	12.8 Auxiliary Power Sources.	59- 36
6.2 Refrigerated Containers Designed to Operate Below 7 psi (103 kPa) and Above 5000 bbls (800 m ³).	59- 17	12.9 Purging Prior to Maintenance.	59- 36
6.3 Refrigerated Containers Designed to Operate Above 15 psi (103 kPa).	59- 20	12.10 Maintenance Records.	59- 36
Chapter 7 Piping, Valves, Process Pressure Vessels, and Equipment	59- 22	Chapter 13 Fire Protection, Safety, and Security	59- 36
7.1 General.	59- 22	13.1 General.	59- 36
7.2 Container Valves and Accessories.	59- 23	13.2 Gas, Fire, and Leak Detection.	59- 37
7.3 Filler and Discharge Pipes and Manifolds.	59- 24	13.3 Container Protection.	59- 37
7.4 Liquid Level Gauging Device.	59- 24	13.4 Fire Protection Water Systems.	59- 37
7.5 Hose Specifications for Nonrefrigerated LP-Gas.	59- 24	13.5 Fire-Extinguishing and Other Fire Protection Equipment.	59- 37
7.6 Drips, Pits, and Drains.	59- 25	13.6 Special Protection.	59- 37
7.7 Pumps and Compressors.	59- 25	13.7 Maintenance of Fire Protection Equipment.	59- 38
		13.8 Personnel Safety.	59- 38
		13.9 Security.	59- 38

Annex A	Explanatory Material	59– 38	Annex D	Relief Device Sizing	59– 46
Annex B	Method of Calculating Maximum Liquid Volume That Can Be Placed in a Container at Any Liquid Temperature	59– 43	Annex E	Sample Ordinance Adopting NFPA 59	59– 46
Annex C	Method of Calculating Maximum Volume of Liquefied Petroleum Gas That Can Be Placed in a Container for Which Length of Fixed Drip Tube Is Set	59– 45	Annex F	Informational References	59– 47
			Index		59– 49

NFPA 59

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex F. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex F.

Chapter 1 Administration

1.1 Scope.

1.1.1* This code shall apply to the design, construction, location, installation, operation, and maintenance of refrigerated and nonrefrigerated utility gas plants including LP-gas containers, piping, and associated process equipment, and controls and fire protection. Coverage begins at:

- (A) The point of transfer when delivery is by cargo tank vehicle or railcar.
- (B) The liquid inlet isolation valve located downstream of hazardous liquid pipeline under the jurisdiction of 49 CFR 195, "Transportation of Hazardous Liquids by Pipeline."
- (C) Coverage shall extend to the point where LP-Gas vapor or a mixture of LP-Gas vapor and air is introduced into the utility distribution system under the jurisdiction of 49 CFR 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards."

1.1.2 Installations that have an aggregate water capacity of 4000 gal (15.14 m³) or less shall conform to NFPA 58.

1.2 Purpose. The purpose of this standard is to provide minimum fire protection, safety, and related requirements for the location, design, construction, security, operation, and maintenance of utility LP-Gas plants.

1.3 Nonapplication of Code. This code shall not apply to the following:

- (1) The design, construction, installation, and operation of marine terminals whose primary purpose is the receipt of LP-Gas for delivery to transporters, distributors, or users.
- (2) The design, construction, installation, and operation of pipeline terminals whose primary purpose is the receipt of LP-Gas for delivery to transporters, distributors, or users
- (3) Operations that involve the liquid transfer of LP-Gas into cylinders or portable tanks (See NFPA 58)
- (4) Portions of LP-Gas systems covered by NFPA 54 where NFPA 54 is adopted, used, or enforced
- (5) Frozen ground containers and underground storage in caverns including piping that is a part of or within the frozen ground container or cavern

1.4 Retroactivity. The provisions of this code reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this code at the time the code was issued.

1.4.1 Unless otherwise specified, the provisions of this code shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the code. Where specified, the provisions of this code shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this code deemed appropriate.

1.4.3 The retroactive requirements of this code shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.4.4* The provisions of Chapter 11 and Chapter 12, with the exception of Section 12.3, shall be applied to all facilities retroactively.

1.5 Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (See Annex E for sample wording for enabling legislation.)

1.7 Pressure Measurement. All pressures expressed in this code are gauge pressures unless specifically noted otherwise.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.
NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2015 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2015 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2016 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2016 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2013 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2016 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2014 edition.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2016 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 290, *Standard for Fire Testing of Passive Protection Materials for Use on LP-Gas Containers*, 2013 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2017 edition.

NFPA 1961, *Standard on Fire Hose*, 2018 edition.

NFPA 1962, *Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances*, 2013 edition.

NFPA 1963, *Standard for Fire Hose Connections*, 2014 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2015 edition.

2.3 Other Publications.

2.3.1 ACI Publications. American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331-3439.

ACI 376, *Code Requirements for Design and Construction of Concrete Structures for the Containment of Refrigerated Liquefied Gases*, 2013.

2.3.2 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 6FA, *Specifications for Fire Tests for Valves*, 2008, reaffirmed 2011.

API 607, *Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats*, 2016.

API 620, *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, 2013, addendum 1, 2014.

API 625, *Tank Systems for Refrigerated Liquefied Gas Storage*, 2010.

2.3.3 ASCE Publications. American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE/SEI 7–10, *Minimum Design Loads for Buildings and Other Structures*, 2013.

2.3.4 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping*, 2014.

Boiler and Pressure Vessel Code, 2015.

2.3.5 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A47/A47M, *Standard Specification for Ferritic Malleable Iron Castings*, 2014.

ASTM A395/A395M, *Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*, 2014.

ASTM A536, *Specifications for Ductile Iron Castings*, 2014.

2.3.6 CSA Group Publications. CSA Group, 178 Rexdale Boulevard, Toronto, ON M9W 1R3, Canada.

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*, 2014.

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

UL 132, *Standard on Safety Relief Valves for Anhydrous Ammonia and LP-Gas*, 2015.

2.3.8 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 49, Code of Federal Regulations, Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards."

Title 49, Code of Federal Regulations, Part 195, "Transportation of Hazardous Liquids by Pipeline."

2.3.9 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*, 2018 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2018 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 API. American Petroleum Institute. [58, 2017]

3.3.2 ASME. American Society of Mechanical Engineers. [58, 2017]

3.3.3 ASME Code. The American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*. [58, 2017]

3.3.4 ASME Container. A container constructed in accordance with the *ASME Code*. [58, 2017]

Δ **3.3.5 ASTM.** American Society for Testing and Materials.

3.3.6 Buried. Installations in which the top of the container (excluding the manway) is below the surrounding grade.

Δ **3.3.7 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. [58, 2017]

3.3.8 Competent Person. One who is trained in identifying existing and predictable hazards and who has authorization to take prompt corrective measures to eliminate them.

N **3.3.9* Component.** A uniquely identifiable part, piece, assembly, or subassembly that performs a distinctive and necessary function in the operation of a LP-Gas facility or system.

3.3.10 Container. Any vessel, including cylinders, tanks, portable tanks, and cargo tanks, used for the transporting or storing of LP-Gases. [58, 2017]

Δ **3.3.11 Container Appurtenances.** Devices installed in container openings for safety, control, or operating purposes. [58, 2017]

3.3.12 Corrosion.

3.3.12.1 Localized Corrosion. Type of corrosion where all or most of the metal loss occurs at discrete areas.

3.3.12.2 Uniform Corrosion. Type of corrosion characterized by an even, regular loss of metal over large areas of the component.

N **3.3.13 Facility.** A number of components installed and designed to function as an independent process as part of an LP-Gas plant.

3.3.14 Field-Erected Container. A container that is fabricated in whole or in part at or near its final location.

3.3.15 Filling Density. The percent ratio of the weight of the LP-Gas in a container to the weight of water at 60°F (16°C) that the container will hold.

3.3.16* Fire Protection. Methods used to achieve any of the following: fire prevention, fire detection, and fire suppression.

3.3.17 Gallon, U.S. Standard. 1 U.S. gal = 0.833 Imperial gal = 231 in.³ = 3.785 L. [58, 2017]

3.3.18* Gas. For the purposes of this code, liquefied petroleum gas (LP-Gas) in either the liquid or vapor state. [58, 2017]

3.3.19* 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. [58, 2017]

3.3.20 Gauge.

3.3.20.1 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. [58, 2017]

Δ **3.3.20.2 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. [58, 2017]

3.3.20.3 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. [58, 2017]

3.3.20.4 Rotary Gauge. A variable liquid level gauge consisting of a small positive shutoff vent valve located at the outside end of a tube that has a bent end inside the container and can be manually rotated to determine the liquid level in the container. It is equipped with a pointer and an outside dial to indicate the liquid level.

3.3.20.5 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, normally installed vertically, that communicates with the container interior, and can be manually moved to determine the liquid level in the container.

3.3.21 Industrial Occupancy. An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted. [5000, 2018]

3.3.22 kPa. Absolute pressure in kilo-Pascals. [58, 2017]

3.3.23 kPag. Gauge pressure in kilo-Pascals. [58, 2017]

3.3.24 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. [58, 2017]

3.3.25 Maximum Allowable Working Pressure (MAWP). The maximum pressure at which a pressure vessel is to operate as described by the ASME *Boiler and Pressure Vessel Code*. [58, 2017]

3.3.26 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. [58, 2017]

Δ **3.3.27 Permitted.** Allowed or acceptable, and not requiring a permit (a document granting permission) to be secured. [58, 2017]

N **3.3.28 Plant.** The entirety of facilities, buildings, and related structures co-located on a single or adjacent property.

Δ **3.3.29 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. [58, 2017]

3.3.30 Portable 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. [58, 2017]

Δ **3.3.31 Pressure Relief Device.** A device designed to open to prevent a rise of internal pressure in excess of a specified value. [58, 2017]

N **3.3.32 Process Pressure Vessel.** A vessel, other than that used as an LP-Gas container (as defined in 3.3.10), operating at pressures exceeding 15 psig (103 kPa) that is used as, but is not limited to, part of the LP-Gas loading/unloading process or for separation, filtering, and mixing/blending in the LP-Gas/LP-Gas-air supply process.

3.3.33 psia. Pounds per square inch, absolute. [58, 2017]

3.3.34 Refrigerated LP-Gas. LP-Gas that is maintained as a liquid at temperatures below ambient temperature to reduce the storage pressure including fully refrigerated LP-Gas at pressures near atmospheric pressure but not exceeding 15 psi (103 kPa) and semi-refrigerated LP-Gas at pressures above 15 psi (103 kPa).

3.3.35 Shop-Fabricated Container. A container that is completely fabricated within a plant under shop-controlled conditions.

3.3.36 Sources of Ignition. Appliances or equipment that, because of their intended modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable gas-air mixtures. [54, 2018]

3.3.37* 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. [58, 2017]

3.3.38 Systems. An assembly of equipment that consists essentially of liquefied petroleum gas unloading equipment; a container or containers; major devices such as vaporizers, relief valves, excess-flow valves, and regulators; and interconnecting piping. In the case of refrigerated storage, it also includes compressors, condensers, and other related equipment and controls. Such systems include any unloading equipment, storage equipment, or interconnecting piping up to the outlet of the first stage regulator, vaporizer, or mixing device, whichever is the last unit before the liquefied petroleum gas enters other plant equipment or distribution lines.

3.3.39 UL. Underwriters Laboratories Inc. [58, 2017]

3.3.40* Utility Gas Plant. A plant that stores and vaporizes LP-Gas for distribution that supplies either LP Gas or LP-Gas gas-air mixtures to a gas distribution system of 10 or more customers.

3.3.41 Valve.

Δ **3.3.41.1 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. [58, 2017]

3.3.41.2 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. [58, 2017]

3.3.41.3 Pressure Relief Valve. A type of pressure relief device designed to both open and close to maintain internal fluid pressure. [58, 2017]

3.3.42 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. [58, 2017]

3.3.42.1* 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. [58, 2017]

3.3.42.2 Electric Vaporizer. A vaporizer that uses electricity as a source of heat. [58, 2017]

3.3.42.2.1 Direct Immersion Electric Vaporizer. A vaporizer wherein an electric element is immersed directly in the LP-Gas liquid and vapor. [58, 2017]

3.3.42.2.2 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. [58, 2017]

3.3.42.3 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. [58, 2017]

3.3.42.4 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. [58, 2017]

3.3.43 Water Capacity. The amount of water at 60°F (16°C) required to fill a container. [58, 2017]

Chapter 4 General Requirements

4.1 Personnel Training. Persons engaged in gas operating and emergency procedures and in the handling of LP-Gas shall be trained at least annually in the properties and safe handling of LP-Gas and in emergency procedures.

4.1.1* Persons engaged in the maintenance or operation of the propane-air mixing equipment, which can affect the safety of the connected utility pipeline, shall be trained to perform those tasks.

4.1.2 Persons engaged in the design, installation, operation, and maintenance of corrosion control systems shall be qualified to perform those tasks.

4.2* Odorizing Gases. All LP-Gases shall be odorized by the addition of a warning agent of such character that they are detectable by a distinct odor down to a concentration in air of not over one-fifth the lower limit of flammability.

Exception: Odorization shall not be required if either of the following conditions is met:

- (1) Odorization is harmful in the use or further processing of the LP-Gas.
- (2) Odorization will serve no useful purpose as a warning agent in such use or further processing.

4.3 Acceptance of Equipment. In systems with containers greater than 2000 gal (7.6 m³) water capacity, each container valve, excess-flow valve, gauging device, relief device directly

connected on the liquefied petroleum gas container, and direct-fired vaporizer shall be approved. (See 3.2.1, *Approved*.)

Δ 4.4 Damage from Vehicles. Where damage to LP-Gas systems from vehicular traffic is a possibility, precautions (such as warning signs, barricades or other devices) shall be taken against such damage.

4.5 Ignition Source Control. [58:6.25]

4.5.1 Scope. [58:6.25.1]

4.5.1.1 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. [58:6.25.1.1]

4.5.1.2* Grounding and bonding for static protection shall not be required on LP-Gas systems.

4.5.2 Electrical Equipment. [58:6.25.2]

Δ 4.5.2.1 Electrical equipment and wiring shall be installed in accordance with *NFPA 70*.

Δ 4.5.2.2* Fixed electrical equipment and wiring installed within the classified areas specified in Table 4.5.2.2 shall comply with Table 4.5.2.2 and shall be installed in accordance with *NFPA 70*.

- **4.5.2.3** 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. [58:6.25.2.5]

4.5.3* Other Sources of Ignition.

4.5.3.1 Smoking shall be permitted only in designated and signposted areas.

Δ 4.5.3.2 Welding, cutting, and hot work shall be conducted in accordance with the provisions of *NFPA 51B*.

Δ 4.5.3.3 Portable electric tools and extension lights capable of igniting LP-Gas shall not be permitted within classified areas except where the area has been identified as free of flammable gases.

Δ 4.5.4 Vehicles and other mobile equipment that constitute potential ignition sources shall be prohibited within diked areas or within 50 ft (15 m) of containers that contain LP-Gas, flammable liquids, or flammable refrigerants, except where authorized and at loading or unloading at facilities specifically designed for the purpose.

4.5.5* If stray currents are present or if impressed currents are used on loading and unloading systems (such as for cathodic protection), protective measures shall be taken to prevent ignition.

Δ 4.5.6 Metallic storage containers for LP-Gas generally do not require lightning protection. Grounding systems shall be provided for LP-Gas storage containers in accordance with Chapter 4, Section 5.4, 7.3.2, and 7.4.1.4 of *NFPA 780*.

4.6 Lighting. Lighting shall be provided to illuminate operating facilities such as walkways, essential control valves, and loading and unloading facilities in particular.

Table 4.5.2.2 Electrical Area Classification

			Equipment Shall Be Approved for <i>National Electrical Code,</i> Class I ^a , Group D ^b
Part	Location	Extent of Classified Area ^a	
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 Table 4.5.2.2	Division 2
B	Refrigerated storage containers	Within 15 ft (4.6 m) in all directions from connections otherwise covered in Table 4.5.2.2	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 (<i>see Figure A.4.5.2.2</i>)	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	Division 1
		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, except within path of discharge	Division 2
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 (<i>see Figure A.4.5.2.2</i>)	Division 2

(continues)

Shaded text = Revisions. **Δ** = Text deletions and figure/table revisions. • = Section deletions. **N** = New material
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Table 4.5.2.2 *Continued*

			Equipment Shall Be Approved for <i>National Electrical Code,</i> Class I ^a , Group D ^b	
Part	Location	Extent of Classified Area ^a		
G	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
H	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		
I	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 (<i>see Figure A.4.5.2.2</i>)	Division 2	

^aThe classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition.

^bSee Article 500 in *NFPA 70* for definitions of classes, groups, and divisions.

^cSee A.4.5.2.2.

4.7 Construction and Modification Records.

4.7.1 Facilities subject to the U.S. Department of Transportation, 49 CFR 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards," shall retain records in accordance with those requirements.

4.7.2 Each new and modified facility shall retain records of materials of construction for process equipment piping systems containing LP-Gas and other flammable fluids, including their supporting system and foundations.

4.7.2.1 The records shall verify that the material properties meet the requirements of this standard and other referenced standards.

4.7.2.2 Components such as pumps, compressors, valves, or similar assemblies are not required to have records of materials

of construction. These records shall document that the assembled component has been designed and constructed per design with materials appropriate for the duty they serve.

4.7.2.3 The records shall be retained for the life of the component, building, foundation, and support system, while in use, and for 5 years thereafter.

N 4.8 Design and Installation.

N 4.8.1 All metallic components (containers, piping, valves, vaporizers, heat exchangers, etc.) containing LP-Gas (liquid or vapor state) that could have their integrity or reliability adversely affected by external, internal, or atmospheric corrosion during their intended service life shall be protected from corrosion.

- N 4.8.2** The design and the installation procedure of external corrosion control cathodic protection systems shall be documented.
- N 4.8.3** Components whose integrity or reliability could be adversely affected by corrosion shall be:
- (1) Protected from corrosion in accordance with Sections 4.8 through 4.12 as applicable
 - (2) Inspected under a program of scheduled maintenance in accordance with 12.3.1 and 12.3.2
- N 4.9 Atmospheric Corrosion Control.**
- N 4.9.1** Each exposed component that is subject to atmospheric corrosion shall be protected from atmospheric corrosion by either of the following:
- (1) A material that has been designed to resist the corrosive atmosphere involved; or
 - (2) Coating or jacketing suitable for the prevention of atmospheric corrosion
- N 4.9.2** Where coatings are used, the component being coated shall be prepared to accept the coating and the coating shall be applied as required by the coating manufacturer to ensure performance of the coating.
- N 4.10* External Corrosion Control: Buried or Submerged Components.**
- N 4.10.1** Each buried or submerged component that is subject to external corrosion shall be protected from external corrosion by:
- (1) Material that has been designed to resist the corrosive environment involved; or
 - (2) Both of the following means:
 - (a)* An external protective coating designed for operating conditions and for the environmental conditions of the installation site, and installed to prevent corrosion of the protected component
 - (b)* A cathodic protection system (impressed current type or galvanic anode system) designed to protect components in their entirety in accordance with the following:
 - (i) The cathodic protection system shall be controlled so not to damage the component or its coating.
 - (ii) Each component under cathodic protection shall be installed with test stations to determine the adequacy of the cathodic protection.
 - (iii) Each test station shall have test leads installed that remain mechanically secure and electrically conductive; are attached to a component to minimize stress conditions on that component; and are coated with electrically insulating material compatible with the coating on the component.
- N 4.10.1.1** Prior to installation, each container, length of pipe, and other components shall be visually inspected at the installation site to identify damage.
- N 4.10.1.1.1** Damage to the container, pipe, or component that could impair its serviceability shall be repaired as permitted by pressure vessel, pipe, and component codes.
- N 4.10.1.1.2** Any coating damage shall be repaired using materials compatible with the existing coating following manufacturer's procedures.
- N 4.10.1.2** Components shall be surrounded by earth or sand that is free of rocks and abrasives, and firmly tamped in place.
- N 4.10.1.3** The portions of a partially underground, unmounted ASME container that are below the surface of the ground and for a vertical distance of at least 3 in. (75 mm) above that surface shall comply with Section 4.8. The remaining above-ground portion of the container shall be coated against atmospheric corrosion.
- N 4.10.1.4** The part of an aboveground ASME container in contact with saddles or foundation shall be provided a means to minimize corrosion.
- N 4.10.2** Where cathodic protection is applied, components that are electrically interconnected shall be protected as a unit.
- N 4.10.3** The requirements of Section 4.10 shall be installed and placed in operation within 1 year after completion of initial system installation.
- N 4.10.3.1** The requirements of Section 4.10 shall not apply where technical documentation that a corrosive environment does not exist is approved by the AHJ. Such documentation shall be based on testing, investigation, or experience in the area of application and shall include, as a minimum, soil resistivity measurements and tests for corrosion accelerating bacteria.
- N 4.10.4** Where insulating devices (flange, fitting, union) for cathodic protection are installed, precaution shall be taken to prevent arcing in areas where combustible atmospheres are anticipated.
- N 4.10.5** Where components are located in close proximity to electric transmission tower footings, ground cables, or counterpoises, or in areas where fault currents or unusual risk of lightning is anticipated, they shall be provided with protection against damage due to fault currents or lightning, and protective measures shall be taken at insulating devices.
- N 4.11 Internal Corrosion Control.** Each component that is subject to internal corrosive attack shall be protected from internal corrosion by one of the following:
- (1) Material that has been designed to resist the corrosive fluid involved; or
 - (2) Coating, inhibitor, or other means
- N 4.12 Interference Currents.**
- N 4.12.1** Each component that is subject to electrical current interference shall be protected by a continuing program to minimize the detrimental effects of interference currents.
- N 4.12.2** Each cathodic protection system shall be designed and installed so as to minimize any adverse effects it might cause to adjacent metal components.
- N 4.12.3** Each impressed current power source shall be installed to prevent adverse interference with communications and control systems.

Chapter 5 Nonrefrigerated Containers

5.1 Provision for Construction and Original Test of Nonrefrigerated Containers.

5.1.1 Shop-fabricated containers shall be designed, constructed, and tested in accordance with one of the following:

- (1) ASME *Boiler and Pressure Vessel Code*, Section VIII, "Rules for Construction of Unfired Pressure Vessels," excluding UG-125 through UG-136
- (2) The rules of the authority under which the containers are installed, provided such rules conform to the rules of ASME *Boiler and Pressure Vessel Code*, Section VIII

5.1.2 The provisions of 5.1.1 shall not be construed as prohibiting the continued use or reinstallation of containers that are constructed and maintained in accordance with ASME *Boiler and Pressure Vessel Code* in effect at the time of fabrication. (See Section 1.5.)

5.2 Design Pressure and Classification of Nonrefrigerated Containers.

5.2.1* Shop-fabricated containers for nonrefrigerated storage shall be in accordance with Table 5.2.1.

5.2.2 Field-erected nonrefrigerated containers shall be built in accordance with ASME *Boiler and Pressure Vessel Code* except that construction using joint efficiencies in Table UW 12, Column C, Division 1, of ASME *Boiler and Pressure Vessel Code* shall not be permitted.

5.2.3 Field-erected containers for nonrefrigerated storage shall be designed for a pressure of not less than 125 percent of the maximum vapor pressure of the product at 100°F (37.8°C) to be stored in the containers, but in no case shall the container be designed for a pressure of 25 psi (172 kPa) or less.

5.3 ASME Container Markings.

5.3.1 ASME containers shall be identified by the attachment of a nameplate.

5.3.1.1 The marking specified shall be on a stainless steel nameplate attached to the container and located to remain visible after the container is installed.

5.3.1.2 The nameplate shall be attached so as to minimize corrosion of the nameplate or its fastening means and so as not to contribute to corrosion of the container.

▲ Table 5.2.1 Minimum Design Pressure for Shop-Fabricated Nonrefrigerated Containers

For Gases with Vapor Pressure at 100°F (37.8°C) Not to Exceed		Minimum Design Pressure (ASME <i>Boiler and Pressure Vessel Code</i> , Section VIII)	
psi	kPa	psi	kPa
80	552	100	689
100	689	125	862
125	862	156	1076
150	1034	187	1289
175	1207	219	1510
215	1482	250	1724

5.3.1.3 Where the container is buried, mounded, insulated, or otherwise covered so as to obscure the nameplate, the information contained on the nameplate shall be duplicated and installed on adjacent piping or on a structure in a clearly visible location.

5.3.2 The container marking shall contain the following information:

- (1) Name and address of the container supplier or the trade name of the container
- (2) Water capacity of the container in pounds or U.S. gallons
- (3) Design pressure in pounds per square inch (psi)
- (4) The wording "This container shall not contain a product having a vapor pressure in excess of ___ psi at 100°F" (see Table 5.2.1)
- (5) Outside surface area in square feet
- (6) Year of manufacture
- (7) Shell thickness and head thickness
- (8)* OL (overall length), OD (outside diameter), HD (head design)
- (9) Manufacturer's serial number
- (10) ASME *Boiler and Pressure Vessel Code* symbol

5.4* Location of Nonrefrigerated Containers.

5.4.1 Nonrefrigerated Aboveground Containers.

5.4.1.1 Containers shall be located outside of buildings.

▲ 5.4.1.2* Containers shall be located in accordance with Table 5.4.1.2 with respect to the distance between containers, the distance between containers and the nearest important building or group of buildings not associated with the utility gas plant, or a line of adjoining property that can be built upon.

5.4.1.3 Spacing of containers from buildings associated with utility gas plants shall be permitted to be reduced to 50 percent of the distances in Table 5.4.1.2, with a minimum separation of 50 ft (15 m).

▲ 5.4.1.4 Multiple aboveground containers (or groups of containers) 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 5.4.1.4.

5.4.1.5 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). [58:6.5.3.6]

▲ 5.4.1.6 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. [58:6.5.3.8]

5.4.1.7 Nonrefrigerated LP-Gas containers shall not be located within dikes that enclose flammable liquid tanks and shall not be located within dikes that enclose refrigerated LP-Gas tanks.

5.4.1.8* 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. [58:6.5.3.4]

Table 5.4.1.2 Nonrefrigerated Container Installation, Minimum Distances

Water Capacity of Each Container		Minimum Distances Between Containers		Minimum Distances from Container to Nearest Important Building or Group of Buildings Not Associated with the Utility Gas Plant or to a Line of Adjoining Property That Can Be Built Upon	
gal	m ³	ft	m	ft	m
<125	<0.5	0	0	0	0
125–250	0.5–1.0	0	0	10	3
251–500	>1.0–1.9	3	1	10	3
501–2000	>1.9–7.6	3	1	25	7.6
2001–30,000	>7.6–114	5	1.5	50	15
30,001–70,000	>114–265			75	23
70,001–90,000	>265–341			100	30
90,001–120,000	>341–454	$\frac{1}{4}$ sum of diameters of adjacent containers		125	38
120,001–200,000	>454–757			200	61
200,001–1,000,000	>757–3785			300	91
1,000,001 or more	Over 3785			400	122

5.4.2 Nonrefrigerated Underground Containers.

5.4.2.1 Underground containers shall include both buried and partially buried (or mounded) containers.

5.4.2.2 Containers shall be located outside of any buildings.

(A) Buildings or roadways shall not be constructed over any underground containers.

(B) Sides of adjacent containers shall be separated by not less than 3 ft (1 m).

5.4.2.3 The orientation of containers shall be in accordance with the following:

- (1) Where containers are installed parallel with ends in line, any number of containers shall be permitted to be in one group.
- (2) Where more than one row is installed, the adjacent ends of the tanks in each row shall be separated by not less than 10 ft (3 m).

5.4.2.4 The location of containers shall be in accordance with the following:

- (1) Containers shall be located not less than 50 ft (15 m) from the nearest important building or group of buildings or line of adjacent property that can be built upon.
- (2) Containers shall be located not less than 50 ft (15 m) from buildings associated with the utility gas plant.
- (3) Containers shall be located not less than 10 ft (3 m) from flammable liquids storage containers.
- (4) Underground containers of 2000 gal (7.6 m³) and less shall be located at least 10 ft (3 m) from the nearest important building or group of buildings, line of adjacent property that can be built upon, or buildings associated with the utility gas plant.

5.4.2.5 The ground within 25 ft (7.6 m) of any underground nonrefrigerated container manway and appurtenances shall be kept clear of ignitable material such as weeds and long, dry grass.

5.4.3 Stacking. Nonrefrigerated containers shall not be stacked one above the other.

Table 5.4.1.4 Fire Protection Requirements for Container Groups

Fire Protection Provided by	Maximum Number of Containers in One Group	Minimum Separation Between Groups	
		ft	m
Hose streams only (See 13.1.1.)	6	50	15.0
Fixed monitor nozzles per 13.4.3.4	6	25	7.6
Fixed water spray per 13.4.3.3	9	25	7.6
Insulation per 13.4.3.1	9	25	7.6

5.4.4 Connection to a Common Manifold. Containers connected to a common manifold shall be installed so that their maximum liquid filling levels present the same plane to minimize the possibility of overfilling lower level tanks.

5.5 Installation of Nonrefrigerated Storage Containers.**5.5.1 Nonrefrigerated Aboveground Containers.**

5.5.1.1 Every container shall be supported to prevent the concentration of excessive loads on the supporting portion of the shell or heads.

5.5.1.2 Supports for containers shall be of solid masonry, concrete, or steel.

(A) Structural metal supports shall be permitted to be employed where they are protected against fire in an approved manner.

(B) Metal supports shall be protected against fire with a material that has a fire resistance rating of at least 2 hours.