NFPA No.
59

LP GASES AT UTILITY GAS PLANTS 1963

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National Fire Protection Association

International

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SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

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Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

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Standard for the Storage and Handling of

Liquefied Petroleum Gases at Utility Gas Plants

NFPA No. 59 — 1963

1963 Edition of No. 59

The 1963 edition of the Standard for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants incorporates changes proposed by the Committee on Gases and adopted by the NFPA at the 1963 Annual Meeting. It supersedes the 1962 edition.

Changes were made in the footnote to 310(b), 314, 471, 618, Appendix C, Appendix E and Appendix F to improve clarity and to conform to current low temperature engineering technology.

Revision to the footnote to 310(b) recognizes the impracticability and lack of necessity for a 100% water head. Change to 314 is to obtain more reproducible test results. 471 was changed to clarify intent of facility duplication. 618 was revised to clarify relieving system design.

Origin and Development of No. 59

The Standard on Liquefied Petroleum Gases (No. 58) was used as a general guide until this separate standard was adopted in 1949. Subsequent editions were adopted in 1954, 1956, 1958 and 1962.

To facilitate the preparation of this standard, the cooperation of the American Gas Association was secured. This resulted in the formation of a special committee under the sponsorship of the American Gas Association, made up of utility engineers, specialists in gas plant construction, and engineers of the liquefied petroleum gas industry. The standard is thus the result of the AGA Committee acting in an advisory capacity to the Sectional Committee on Utility Gas of the NFPA Committee on Gases.

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Contents

Interpretation Procedure of the Committee on Gases

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts.

Standard for the Storage and Handling of

Liquefied Petroleum Gases at Utility Gas Plants

NFPA No. 59 — 1963

SECTION 1. GENERAL REQUIREMENTS

11. Introduction.

110. This standard recommends basic requirements. The principal purpose of this standard is to outline methods for protection of persons and property by providing in a condensed form a standard of reference to serve as a guide to all persons concerned with the construction and operation of liquefied petroleum gas equipment at utility gas plants.

111. The term "liquefied petroleum gases" as used in this standard shall mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene, butanes (normal butane or isobutane), and butylenes.

112. In the interest of safety, it is important that persons engaged in handling liquefied petroleum gases understand the properties of these gases and that they be thoroughly trained in safe practices for the handling and distribution of these products.

113. Under moderate pressure the gases liquefy, but upon relief of the pressure are readily converted into the gaseous phase. Under moderately low temperature the gases liquefy. Advantage of this characteristic is taken by the industry. Generally the gases are shipped and stored under pressure as liquids. The escape of liquid into the atmosphere normally results in instantaneous vaporization, with the volume of gases being between 200 and 300 times the volume of escaping liquid. When in the gaseous state these gases are heavier than air and have a narrower range of flammability than natural or manufactured gas.

114. In the case of pure product at atmospheric pressure and below 31 F., normal butane is a liquid. Propane is a liquid at atmospheric pressure at temperatures below minus 44 F. and

normally does not present a flammable liquid hazard except when stored at or below its boiling point.

115. Commercially available butane and propane may have different liquefying points from those in Par. 113 because they normally contain various percentages of other hydrocarbon products.

116. Rapid vaporization takes place at temperatures above the boiling points (normal butane about 31 F.; propane about minus 44 F.). Normally these gases are stored as a liquid under pressure; however, in refrigerated storage these gases are frequently stored at or below the boiling point at practically atmospheric pressure.

12. Application of Rules.

120. The following standard is intended to apply to utility gas companies for the design, construction, location, installation, and operation of refrigerated and nonrefrigerated liquefied petroleum gas systems.

121. When operations involving container charging or transportation of liquefied petroleum gas in liquid form are carried out on the same property, these operations shall conform to Standard for the Storage and Handling of Liquefied Petroleum Gases (No. 58).*

122. Installations having an aggregate water capacity not exceeding 2,000 gallons shall conform to Standard for the Storage and Handling of Liquefied Petroleum Gases (No. 58).*

13. Definitions.

130. The term "gas" in this standard shall refer to liquefied petroleum gases in either the liquid or gaseous state.

131. The term "containers" includes all vessels such as tanks, cylinders or drums used for storing liquefied petroleum gases.

132. The term "systems" as used in this standard refers to an assembly of equipment consisting essentially of liquefied petroleum gas unloading equipment, container or containers, major devices such as vaporizers, relief valves, excess flow

*See Appendix G, page 59–48, for availability.

valves, regulators, and interconnecting piping. In the case of refrigerated storage, it would also include compressors, condensers, and other related equipment and controls. Such systems shall 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.

133. The designation of containers used for storing any of the liquefied petroleum gases defined in this standard shall depend on the type of construction employed during its fabrication.

(a) Containers completely fabricated within a plant under shop controlled conditions shall be known as "shop fabricated containers."

(b) Containers fabricated in whole or in part at or near their final location shall be known as "field erected containers."

134. The term "buried" refers to installations in which the top of the container (excluding the manway) is below the surrounding grade. The term "partially buried" (or mounded) refers to installations in which the top of the container is above the surrounding grade and is covered with earth.

135. The abbreviations "psig" and "psia" as used in this standard refer to pounds per square inch gauge and pounds per square inch absolute, respectively.

14. Odorizing Gases.

140. All liquefied petroleum gases shall be effectively odorized by an approved agent of such character as to indicate positively, by a distinctive odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of flammability; provided, however, that odorization is not required if harmful in the use or further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

NOTE: The lower limits of flammability of the more commonly used liquefied petroleum gases are: Propane, approximately 2 per cent; Butane, approximately 1½ per cent. These figures represent volumetric percentages of gas in a gas-air mixture in each case.

141. The odorization requirement of 140 shall be considered to be met by the use of: 1.0 pounds of ethyl mercaptan, 1.0

pounds of thiophene, or 1.4 pounds of amyl mercaptan per 10,000 gallons of LP-Gas. However, this listing of odorants and quantities shall not exclude the use of other odorants that meet the odorization requirement of 140.

15. Approval of Equipment.

150. In systems utilizing containers of over 2,000 gallons 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 have its correctness as to design, construction, and performance determined by:

(a) Listing by Underwriters' Laboratories, Inc., or

(b) Listing by a nationally recognized agency for liquefied petroleum gas use, or

(c) The authority having jurisdiction.

16. Damage from Vehicles.

160. Where damage to liquefied petroleum gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

17. Electrical Equipment.

170. Electrical installations and equipment shall conform to the provisions of the National Electrical Code (No. 70)* or be such as may be required and approved by the authority having jurisdiction.

171. Adequate lighting shall be provided to illuminate operating facilities such as walkways and essential control valves.

18. Sources of Ignition.

180. Open flames and other sources of ignition shall not be permitted in vaporizer rooms, gas mixing rooms, and similar locations. Direct-fired vaporizers shall be located outside or in a separate room or building.

181. Liquefied petroleum gas storage containers do not require lightning protection. (See Paragraph 326, Code for Protection Against Lightning, NFPA No. 78.)*

*See Appendix G, page 59–48, for availability.

182. Since liquefied petroleum gas is contained in a closed system of piping and equipment, the system need not be electrically conductive or electrically bonded for protection against static electricity. (See Paragraph 6130, Static Electricity, NFPA No. 77M.)*

183. If the presence of stray electric currents is indicated as a cause of corrosion due to electrolysis, proper provision shall be made for suitable protection.

SECTION 2. NONREFRIGERATED CONTAINERS.

21. Requirement for Construction and Original Test of Nonrefrigerated Containers.

210. Shop fabricated containers shall be designed, constructed and tested in accordance with the Unfired Pressure Vessel Code sponsored by either the American Society of Mechanical Engineers (ASME)* or the American Petroleum Institute and the American Society of Mechanical Engineers (API-ASME)** or in accordance with the rules of the authority under which the containers are installed, provided such rules substantially conform with the rules of the ASME Code or the API-ASME Code.

(a) Containers constructed according to the 1949 and earlier editions of the ASME Code need not comply with the paragraphs U-2 to U-10 inclusive and U-19. Containers constructed according to paragraph U-70 are not authorized.

(b) Containers constructed according to API-ASME Code need not comply with the Section I or with appendix to Section I of said Code. Paragraphs W-601 to W-606 inclusive in the 1943 and earlier editions of said Code do not apply.

211. The provisions of 210 shall not be construed as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the Code in effect at the time of fabrication.

*See Appendix G, page 59–48, for availability of standards.

**Construction of containers under the API-ASME Code is not authorized after July 1, 1962.

22. Design Pressure and Classification of Nonrefrigerated Containers.

220. Shop fabricated storage containers for nonrefrigerated storage shall be designed and classified as follows:

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gauge at 100 F. (37.8 C.)	Minimum Design Pressure of Container lb. per sq. in. gauge: 1949 and earlier editions of ASME Code (Par. U-68, U-69)	Minimum Design Pressure of Container lb. per sq. in. gauge: 1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956 and 1959 editions of ASME Code; All editions of API-ASME Code†
80*	80*	80*	100*
100	100	100	125
125	125	125	156
150	150	150	187
175	175	175	219
200**	215	200	250

*New storage containers of the 80 type have not been authorized since Dec. 31, 1947.

**Container type may be increased by increments of 25. The minimum design pressure of containers shall be 100% of the container type designation when constructed under 1949 or earlier editions of the ASME Code (Par. U-68 and U-69). The minimum design pressure of containers shall be 125% of the container type designation when constructed under: (1) the 1949 ASME Code (Par. U-200 and U-201), (2) 1950, 1952, 1956 and 1959 editions of the ASME Code, and (3) all editions of the API-ASME Code.

†Construction of containers under the API-ASME Code is not authorized after July 1, 1962.

NOTE: Because of low soil temperature usually encountered, and the insulating effect of the earth, the average vapor pressure of products stored in underground containers will be materially lower than when stored aboveground. This reduction in actual operating pressure therefore provides a substantial corrosion allowance for these containers when installed underground.

221. Field-erected nonrefrigerated containers shall be built in accordance with applicable provisions of the 1959 edition of the ASME Boiler and Pressure Vessel Code Section VIII, Unfired Pressure Vessels, except that construction using joint efficiencies in Tables UW12, Column C is not permitted.

222. Field-erected containers for nonrefrigerated storage shall be designed for a pressure not less than 125% of the maximum vapor pressure of the product at 100 F. to be stored in the containers, but in no case shall the container be designed for a pressure of 25 psig or less.

223. The shell or head thickness of any nonrefrigerated container shall not be less than $\frac{3}{16}$ inch.

23. Markings on Nonrefrigerated Containers.

230. Each container for nonrefrigerated storage shall be marked as specified in the following:

(a) With a marking identifying compliance with, and other markings required by the rules of the code under which the container is constructed; or with the stamp and other markings required by the National Board of Boiler & Pressure Vessel Inspectors.

Underground: Container and an accessible name plate.
Aboveground: Container.

(b) With notation as to whether system is designed for underground or aboveground installation.

Underground: Container and an accessible name plate.
Aboveground: Container.

(c) With the water capacity of the container in gallons, U. S. Standard.

Underground: Container and an accessible name plate.
Aboveground: Container.

(d) With the pressure in pounds per square inch for which the container is designed.

Underground: Container and an accessible name plate.
Aboveground: Container.

(e) With the wording "This container shall not contain a product having a vapor pressure in excess of —— lbs. per sq. in. gauge at 100 F." (See 220 and 222.)

Underground and aboveground: A name plate or tag on filler connection.

(f) With the outside surface area in square feet.

Underground: Container and an accessible name plate.
Aboveground: Container.

(g) With marking indicating the maximum level to which the container may be filled with liquid at temperatures between 20 F. and 130 F. except on containers provided with fixed maximum level indicators. Markings shall be in increments of 20 F.

Aboveground and underground: System name plate or on liquid level gauging device.

24. Location of Nonrefrigerated Containers.

240. Nonrefrigerated Aboveground Containers

(a) Containers shall be located outside of buildings.

(b) Containers shall be located in accordance with the following table:

Water capacity of each container in gallons	Minimum Distances	
	Between containers† in feet	From container to nearest important building or group of buildings, or a property line which may be built upon in feet
2,001 to 30,000	5	50
30,001 to 70,000	¼ of sum of diameters of adjacent containers	75
70,001 to 125,000	"	100
125,001 to 200,000	"	200
200,001 to 1,000,000	"	300
1,000,001 or more	"	400

†The minimum distance requirement for spacing between containers when the water capacity of a container is 180,000 gallons or more shall be at least 25 feet. The minimum distance requirement for spacing between groups of containers when a group of two or more containers has an aggregate water capacity of 180,000 gallons or more shall be at least 25 feet.

(c) A container or containers with an aggregate water capacity in excess of 180,000 gallons, and their loading stations should be located 100 feet or more from buildings occupied for generation, compression or purification of manufactured gas, or from natural gas compressor buildings, or from outdoor installations essential to the maintenance of operation in such buildings. Such container or containers and their loading stations should be 100 feet or more from aboveground storage of flammable liquids and

from any buildings of such construction or occupancy which constitutes a material hazard of exposure to the containers in the event of fire or explosion in said buildings. If the container or containers are located closer than 50 feet to any such buildings or installations, then the latter shall be protected by walls adjacent to such storage containers or by other appropriate means against the entry of escaped liquefied petroleum gas, or of drainage from the storage container area and its loading points — all in such a manner as may be required and approved by the authority having jurisdiction.

(d) Nonrefrigerated liquefied petroleum gas containers shall not be located within dikes enclosing flammable liquid tanks, and shall not be located within dikes enclosing refrigerated liquefied petroleum gas tanks.

241. Nonrefrigerated Underground Containers

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

(b) Containers shall be located outside of any buildings. Buildings or roadways shall not be constructed over any underground containers. Sides of adjacent containers shall be separated by not less than 3 feet.

(c) When containers are installed parallel with ends in line, any number of containers may be in one group. When more than one row is installed, the adjacent ends of the tanks in each row shall be separated by not less than 10 feet.

(d) Containers and their loading stations shall be located not less than 50 feet from the nearest important building or group of buildings or line of adjacent property which may be built upon.

(e) The containers and their loading stations should be located not less than 50 feet from buildings occupied for generation, compression or purification of gas, or from outdoor installations essential to the maintenance of operation in such buildings. They should be located not less than 50 feet from aboveground storage of flammable liquids and from any buildings of such construction or occupancy which constitutes a severe exposure to any aboveground appurtenances of the underground installation in the event of fire or explosion in said buildings. If the underground installations

by necessity are located closer than 50 feet to any such buildings or installations, then the latter shall be protected against the entry of escaping liquefied petroleum gas, in such a manner as may be required and approved by the authority having jurisdiction.

242. Nonrefrigerated containers shall not be stacked one above the other.

243. The ground within 25 feet of any aboveground nonrefrigerated container shall be kept clear of readily ignitible material such as weeds and long dry grass.

244. In cases where nonrefrigerated containers are to be installed in heavily populated or congested areas, the authority having jurisdiction shall determine restrictions of individual tank capacity, total storage, distance to line of adjoining property which may be built on or other reasonable protective methods.

25. Installation of Nonrefrigerated Storage Containers.

250. Nonrefrigerated Aboveground Containers

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

(b) Supports for containers shall be of solid masonry, concrete or steel. Structural metal supports may be employed when they are protected against fire in an approved manner. Steel supports shall be protected against fire with a material having a fire resistance rating of at least two hours. Steel skirts having only one opening shall be protected as above but fireproofing need only be applied to the outside of the skirt.

(c) Horizontal containers shall be mounted on saddles in such a manner as to permit expansion and contraction, not only of the container but also of the connected piping. Only two saddles shall be used.

(d) Suitable means to prevent corrosion shall be provided on that portion of the container in contact with the foundations or saddles.

(e) Containers should be kept properly painted or otherwise protected from the elements.

251. Nonrefrigerated Underground Containers

(a) Buried containers shall be placed so that the top of the container is not less than 6 inches below the grade of the surrounding area. Partially buried (or mounded) containers shall have not less than 12 inches of cover, sufficient to provide surface drainage without erosion or other deterioration.

(b) The container manway shall not be covered with the backfill or mounding material. Under conditions where the container manway cover is below the ground level, a manway providing sufficient access shall be installed. No other part of the container shall be exposed.

(c) The containers shall be set on a firm foundation or firm undisturbed earth and surrounded with soft earth or sand well tamped into place. Provision shall be made to take care of settling and rotation.

(d) Containers shall be adequately protected against corrosion.

(e) Bottom connections to the container shall be prohibited. All connections shall be in the container manway or at openings along the top length of the container.

252. Field welding where necessary shall be made only on saddle plates or brackets which were applied by manufacturer of container, except as provided by the code under which the container was fabricated.

253. Secure anchorage or adequate pier height shall be provided to protect against container flotation wherever sufficiently high water might occur.

254. When flammable liquid storage tanks are in the same general area as liquefied petroleum gas containers, the flammable liquid storage tanks shall be diked or diversion curbs or grading used to prevent accidentally escaping flammable liquids from flowing into liquefied petroleum gas container areas.

255. The container storage area shall be fenced or otherwise protected where necessary and at least two points of access through the fencing, if used, shall be provided.

26. Reinstallation of Nonrefrigerated Containers.

260. Containers once installed underground or aboveground

which have been out of service for more than one year, shall not be reinstalled aboveground or underground, unless they successfully withstand without distortion hydrostatic pressure retests at the pressure specified for the original hydrostatic test as required by the code under which constructed, and show no evidence of serious corrosion. Reinstallation of containers in all other respects shall be in accordance with all the provisions listed in this standard. (See 25. See also Section 6 for relief valve requirements.)

27. Gaskets.

270. The gaskets for use on storage containers shall be resistant to the action of liquefied petroleum gas in the liquid phase. Gaskets shall be made of metal having a melting point of over 1500 F. or shall be confined within an assembly having a melting point of over 1500 F. Aluminum "O" rings and spiral wound metal gaskets are also acceptable. When a flange is opened, the gasket shall be replaced.

28. Filling Densities.

280. The "filling density" is defined as the per cent ratio of the weight of the gas in a container to the weight of water at 60 F. that the container will hold. Except as noted in 282, nonrefrigerated containers shall be filled according to the following filling densities:

MAXIMUM PERMITTED FILLING DENSITY

Specific Gravity at 60 F. (15.6 C.)	Aboveground Containers: 0 to 1200 U.S. Gals. (1000 Imp. gal., 4550 liters) Total Water Cap.	Aboveground Containers: Over 1200 U.S. Gals. (1000 Imp. gal., 4550 liters) Total Water Cap.	Underground Containers All Capacities
.496—.503	41%	44%	45%
.504—.510	42	45	46
.511—.519	43	46	47
.520—.527	44	47	48
.528—.536	45	48	49
.537—.544	46	49	50
.545—.552	47	50	51
.553—.560	48	51	52
.561—.568	49	52	53
.569—.576	50	53	54
.577—.584	51	54	55
.585—.592	52	55	56
.593—.600	53	56	57

281. The maximum liquid volume in per cent of the total container capacity may be determined for nonrefrigerated liquefied petroleum gases at any liquid temperature by using the formula shown in Appendix C.

282. For individual underground nonrefrigerated installations, the authority having jurisdiction may authorize the use of increased filling densities where the maximum ground temperatures do not exceed 60 F. These filling densities shall be based upon sound engineering practices for the operating conditions involved.

SECTION 3. REFRIGERATED CONTAINERS.

31. Requirements for Construction, Design and Original Test of Refrigerated Containers.

310. Refrigerated containers shall be built in accordance with applicable provisions of one of the following codes as appropriate for conditions of maximum allowable working pressure, design temperature, and hydrostatic testing:

(a) For pressures of 15 psig or more use the 1959 edition of the ASME Boiler and Pressure Vessel Code Section VIII, Unfired Pressure Vessels, except that construction using joint efficiencies in Table UW12, Column C is not permitted.

(b) For pressures below 15 psig use API Standard 620, Recommended Rules for the Design and Construction of Large, Welded, Low Pressure Storage Tanks.* (Tentative) First Edition 1956 and Addenda 1958.

311. Field-erected containers for refrigerated storage shall be designed as an integral part of the storage system including tank insulation, compressors, condensers, controls, and piping. Proper allowance shall be made for the service temperature limits of the particular process and the products to be stored when determining material specifications and the design pressure. Welded construction shall be used. All main shell seams shall receive complete acceptable radiographic examination.

*The thickness of the container may be determined using the maximum expected density of the product to be stored instead of the density used in API Standard 620 but, in no case during test, should any portion of the container be stressed more than 80% of the minimum specified yield strength of any of the material.

312. Materials having ductility and impact resistance at the design temperature equal to or superior to those listed in Appendix F shall be used in the fabrication of containers for refrigerated storage of liquefied petroleum gas.

313. When austenitic steels or nonferrous materials are used, the ASME Code shall be used as a guide in the selection of materials for use at the design temperature.

314. Materials for nozzles, attached flanges, structural members which are in tension, and other such critical elements shall be selected for the design temperature based on impact test requirements. Materials which are certified by impact testing shall absorb 15 ft.-lbs. Charpy V-notch tests at the lowest expected service temperature.

315. The design temperature shall be the lower of the following:

(a) The minimum temperature to which the container contents will be refrigerated.

(b) The minimum anticipated container shell temperature due to atmospheric temperature considering the effectiveness of the insulation in keeping shell temperature above expected minimum atmospheric temperature where atmospheric temperature below the refrigerated temperature may be expected.

316. The provisions of 310 shall not be construed as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the Code in effect at the time of fabrication.

32. Markings on Refrigerated Containers.

320. Each refrigerated container shall be identified by the attachment of a nameplate on the outer covering in an accessible place marked as specified in the following:

(a) Manufacturer's name and date built.

(b) With liquid volume of the container in gallons U. S. Standard.

(c) With the maximum allowable working pressure in pounds per square inch.

(d) With the minimum temperature in degrees Fahrenheit for which the container was designed.

(e) The maximum allowable water level to which the container may be filled for test purposes.

(f) With the density of the product to be stored in pounds per cubic ft. for which the container was designed.

(g) With the maximum level to which the container may be filled with the liquefied petroleum gas for which it was designed.

33. Location of Refrigerated Containers.

330. Refrigerated Aboveground Containers.

(a) Containers shall be located outside of buildings.

(b) Containers shall be located in accordance with the following table:

Water capacity of each container in gallons	Minimum Distances	
	Between containers in feet	From container to nearest important building or group of buildings, or a property line which may be built upon in feet
200,001 to 1,000,000	¼ of sum of diameters of adjacent containers	300 feet
1,000,001 or more		400 feet

(c) A container or containers with an aggregate water capacity in excess of 180,000 gallons, and their loading stations should be located 100 feet or more from buildings occupied for generation, compression or purification of manufactured gas, or from natural gas compressor buildings, or from outdoor installations essential to the maintenance of operation in such buildings. Such container or containers and their loading stations should be 100 feet or more from aboveground storage of flammable liquids and from any buildings of such construction or occupancy which constitute a material hazard of exposure to the containers in the event of fire or explosion in said buildings. If the container or containers are located closer than 50 feet to any such buildings or installations, then the latter shall be protected by walls adjacent to such storage containers or by other appropriate means against the entry of escaped liquefied petroleum gas, or of drainage from the storage container area and its loading points — all in such a manner as may be required and approved by the authority having jurisdiction.

(d) Refrigerated liquefied petroleum gas containers shall not be located within dikes enclosing flammable liquid tanks or within dikes enclosing nonrefrigerated liquefied petroleum gas containers.

331. Refrigerated containers shall not be installed one above the other.

332. The ground within 25 feet of any aboveground refrigerated container and all ground within a diked area shall be kept clear of readily ignitible material such as weeds and long dry grass.

333. In cases where refrigerated containers are to be installed in heavily populated or congested areas, the authority having jurisdiction shall determine restrictions of individual container capacity, total storage, distance to line of adjoining property which may be built on or other reasonable protective methods.

34. Installation of Refrigerated Containers.

340. Refrigerated aboveground containers shall be installed on the ground, or on foundations or supports of concrete, masonry piling, or steel. Foundations and supports shall be protected to have a fire-resistance rating of not less than two hours.

341. Containers for product storage at less than 30 F. shall be supported in such a way or heat supplied to prevent the effects of freezing and consequent frost heaving.

342. Any insulation used shall be noncombustible and shall resist dislodgment by fire hose streams.

343. Refrigerated storage containers shall be provided with a means for containment having a volumetric capacity of 150% of the container or containers within the area. Except where protection is provided by natural topography, dikes or retaining walls shall be required and shall be of earth, concrete, or solid masonry designed to be liquidtight and to withstand a full hydraulic head, and so constructed as to provide the required protection. Earthen dikes shall have a flat section at the top not less than two feet wide. The slope shall be consistent with the angle of repose of the material of which the dikes are constructed. The walls of the dikes shall be as low as practicable but not less than 5 feet in height. When provision is made for draining rain water from diked areas, such drains shall be kept closed and shall be operated so that when in use they will not permit tank

contents to enter natural water courses, public sewers, or public drains. When pumps control drainage from the diked area, they shall not be self-starting.

344. Field welding on container where necessary shall be made only on saddle plates or brackets which were applied by manufacturer of container, except as provided by the code under which the container was fabricated.

345. Secure anchorage or adequate pier height shall be provided to protect against container flotation wherever sufficiently high water might occur.

346. When flammable liquid storage tanks are in the same general area as liquefied petroleum gas containers, the flammable liquid storage tanks shall be diked or diversion curbs or grading used to prevent accidentally escaping flammable liquids from flowing into liquefied petroleum gas container areas.

347. The container storage area shall be fenced or otherwise protected where necessary and at least two points of access through the fencing, if used, shall be provided.

35. Reinstallation of Refrigerated Containers.

350. Containers once installed, which have been out of service for more than one year, shall not be put back in service, unless they successfully withstand without distortion hydrostatic pressure retests at the pressure specified for the original hydrostatic test as required by the code under which constructed, and show no evidence of serious corrosion. Reinstallation of containers in all other respects shall be in accordance with all the provisions listed in this standard. (See 34. See also Section 6 for relief valve requirements.)

36. Gaskets.

360. The gaskets for use on storage containers shall be resistant to the action of liquefied petroleum gas in the liquid phase. Gaskets shall be made of metal having a melting point of over 1500 F. or shall be confined within an assembly having a melting point of over 1500 F. Aluminum "O" rings and spiral-wound metal gaskets are also acceptable. When a flange is opened, the gasket shall be replaced.

37. Filling Densities.

370. The filling limits for refrigerated storage containers shall be based upon sound engineering practice for the individual design and operating conditions involved. Since negligible expansion of the liquid can take place within the possible range of operating pressure and temperature of a refrigerated container, the maximum liquid volume in per cent of the total container capacity may be greater for a refrigerated container than normally employed for a nonrefrigerated container

SECTION 4. PIPING, VALVES, GAUGING DEVICES.

41. Piping Materials.

410. Seamless copper, brass, or steel pipe or tubing may be used for sizes ½ in. or under. All piping and pipe fittings over ½ in. size, connected to a storage container, shall be made of steel. All piping or tubing shall be tested after installation at 1½ times the maximum working pressures to which it may be subjected.

411. Piping connections to the container for sizes over 2 inches nominal pipe diameter shall be welded flanges or straight welded, with the possible exception of piping connections for excess flow valves and for relief valve risers.

412. The use of cast iron valves, pipe and fittings shall be prohibited in piping carrying liquefied petroleum gas in the liquid phase. This does not prohibit the use of container valves or fittings made of malleable or nodular iron.*

413. Valve seat material, packing, gaskets, etc., shall be resistant to the action of liquefied petroleum gas in the liquid phase.

414. All piping, tubing, fittings and the valves shall be leak tested after assembly and proved free from leaks at not less than normal operating pressures. Test shall not be made with a flame.

415. Provision shall be made for expansion, contraction, jarring and vibration, and for settling.

416. Piping outside buildings may be buried aboveground, or both, but shall be well supported and protected against physical damage and corrosion.

417. Piping, valves, fittings and gauging devices for the refrigerated portion of the liquefied petroleum gas system shall be based on sound engineering practices for the individual design and operating conditions involved.

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*For information as to the suitability of malleable or nodular iron for this use, refer to Standards of the American Society for Testing and Materials (A47–52 or A339–51T). See Appendix G, page 59–48, for availability.

42. Container Valves and Accessories.

420. All shutoff valves and accessory equipment (liquid or gas) shall be suitable for use with liquefied petroleum gas, and designed for not less than the maximum extreme pressure and temperature to which they may be subjected. Valves for use with nonrefrigerated containers which may be subjected to container pressure shall have a rated working pressure of at least 250 psig. Cast iron valves, piping, and fittings shall be prohibited on liquefied petroleum gas containers and their connections. This does not prohibit the use of container valves or fittings made of malleable or nodular iron.*

421. All connections to containers, except safety relief connections, liquid level gauging devices, and plugged openings, shall have shutoff valves located as close to the container as practicable.

422. Excess flow valves where required by this standard shall close automatically at those rated flows of vapor or liquid as specified by the manufacturer. The connections or line including valves, fittings, etc., downstream of an excess flow valve shall have a greater capacity than the rated flow of the excess flow valve.

423. Except as provided in 424 and 443, all liquid and vapor connections on containers except safety relief connections shall be equipped with approved automatic excess flow valves, or with back pressure check valves, or a remotely controlled automatic quick-closing valve which shall remain closed except during operating periods. The mechanism for remotely controlled, quick-closing valves shall be provided with a secondary control equipped with a fusible release (not over 220 F. melting point) which will cause the quick-closing valve to close automatically in case of fire.

424. Openings from a container or through fittings attached directly on the container to which pressure gauge connection is made, need not be equipped with an excess flow valve if such openings are not larger than No. 54 drill size.

425. Excess flow and back pressure check valves where required by this standard shall be located inside of the container or at a point outside where the line enters the container; in the latter case, installation shall be made in such a manner that any undue stress beyond the excess flow or back pressure check valve will not cause breakage between the container and such valve.

*See footnote, page 59–22.

426. Excess flow valves shall be designed with a by-pass, not to exceed a No. 60 drill size opening to allow equalization of pressures.

427. All inlet and outlet connections except safety valves, liquid level gauging devices and pressure gauges on any container shall be labeled or color coded to designate whether they are connected to vapor or liquid space. Labels may be on valves.

428. Each storage container shall be provided with a suitable pressure gauge.

43. Filler and Discharge Pipes, Manifolds.

430. Piping connections between container and manifold should be designed to provide adequate allowances for contraction, expansion, vibration, and settlement. Compression type couplings shall not be considered suitable for this purpose.

431. It is desirable that liquid manifold connections be located at non-adjacent ends of parallel rows of containers.

432. The use of non-metallic hose is prohibited for interconnecting stationary containers.

433. A good test for determination of piping stresses consists of unbolting piping at a flange and noting whether the flange remains in proper alignment.

434. The filling pipe inlet terminal shall not be located inside a building. Such terminals shall be located not less than 10 feet from any building, and preferably not less than 5 feet from any driveway, and shall be properly supported and protected from physical damage.

435. A shutoff valve shall be provided in liquid piping for each section of pipe containing 500 gallons capacity when the pipe is within 300 feet of storage containers or other important aboveground structures.

436. When the liquid line manifold connecting containers in a group has a volumetric capacity of more than 100 gallons, such container manifolds shall be located not less than 100 feet from the nearest adjacent property owned by others which may be built upon. The manifold piping terminates at the first line valve which may be used to isolate the manifolded containers from any other part of the liquid line system.

437. If more than three storage containers discharge liquid into a manifold whose nominal diameter is greater than 2 inches and if the flow capacity of such manifold is less than the total discharge capacity of the discharge lines from the containers, one of the following for each container shall be provided:

(a) A remotely controlled external shutoff valve in combination with an excess flow valve.

(b) A remotely controlled quick-closing valve which shall remain closed except during operating periods. The mechanism for such valves may be provided with a secondary control equipped with a fusible release (not over 220 F. melting point) which will cause the quick-closing valve to close automatically in case of fire.

44. Liquid Level Gauging Device.

440. Each nonrefrigerated storage system shall be equipped with a liquid level gauging device of approved design, such as a pressure differential type, a float gauge, a rotary gauge, slip tube, magnetic or fixed tube device. If the liquid level gauging device is a float type or a pressure differential type and the container is a nonrefrigerated type, the container shall also be provided with an auxiliary gauging device such as: a fixed dip tube, slip tube, rotary gauge, or similar device.

441. Refrigerated containers shall be equipped with a liquid level gauging device. An auxiliary gauging device is not required for refrigerated containers. However, in lieu of an auxiliary gauge, refrigerated containers, if subject to overfilling, shall be equipped with an automatic device to interrupt filling of the tank when the maximum filling level is reached.

442. All gauging devices shall be arranged so that the maximum liquid level for butane, for a 50–50 mixture of butane and propane, and for propane, to which the container may be filled is readily determinable.

443. Gauging devices that require bleeding of the product to the atmosphere, such as the rotary tube, fixed tube and slip tube, shall be so designed that the bleed valve maximum opening is not larger than a No. 54 drill size, unless provided with an excess flow valve.

444. Gauging devices for containers shall have a maximum allowable working pressure at least equal to that of the containers to which they are attached.

445. Length of a fixed tube device shall be designed to indicate the maximum level to which the container may be filled for the product contained. This level shall be based on the volume of the product at 40 F. at its maximum permitted filling density for aboveground containers and at 50 F. for buried containers. Refer to Appendix D for calculating filling point for which tube shall be designed.

446. Gauge glasses of the columnar type shall not be permitted.

45. Hose Specifications.

450. Hose shall be fabricated of materials that are resistant to the action of liquefied petroleum gas.

451. Hose subject to container pressure shall be designed for a bursting pressure of not less than five times the pressure for which the container was designed. Hose connections when made shall be capable of withstanding a test pressure of twice the pressure for which the container is designed.

452. Hose and hose connections located on the low pressure side of regulators or reducing valves shall be designed for a bursting pressure of not less than 125 pounds per square inch but not less than five times the pressure setting of the safety relief devices protecting that portion of the system. There shall be no leakage from assembled hose connections.

46. Drips, Pits and Drains.

460. Where vaporized gas may condense, suitable means shall be provided for re-vaporization or disposal of the condensate.

461. Every effort should be made to avoid the use of pits. If pits are used they shall be fitted with continuous automatic flammable vapor detecting devices equipped with an alarm. No drains or blow-off lines shall be directed into or in proximity to sewer systems used for other purposes.

47. Pumps and Compressors.

470. Each pump and compressor shall be suitable for the liquefied petroleum gas service intended. Each pump and compressor shall be marked with its maximum working pressure.

471. Refrigerated storage systems shall be provided with sufficient capacity to maintain all containers at a pressure not in

excess of the operating pressure under summer weather conditions and shall be provided with additional capacity for filling or stand-by service. Unless facilities are provided to safely dispose of vented vapors while the refrigeration system is inoperative, at least two (2) compressors shall be installed where compressors and condensers are used. Compressor capacity provided for stand-by service shall be capable of handling the volume of vapors necessary to be evolved to maintain operating pressure. Auxiliary equipment, such as fans, circulating water pumps, and instrument air compressors, shall be provided with spare or stand-by facilities sufficient to insure that prolonged failure of refrigeration may be prevented.

472. Adequate means shall be available for operating equipment in event of failure of normal facilities.

48. Protection of Container Accessories.

480. Valves, regulating, gauging, and other container accessory equipment shall be protected against tampering and physical damage.

NOTE: The use of other than frangible type locks is not desirable because it prevents access to gas controls in case of emergency.

481. All connections on underground containers shall be located within a substantial dome, housing, or manhole and protected by a substantial round cover. (See 641.)

SECTION 5. VAPORIZERS.

51. General.

510. Liquefied petroleum gas storage containers shall not be directly heated with open flames.

511. Heating or cooling coils shall not be installed inside of a storage container.

512. Vaporizers shall not be equipped with fusible plugs for pressure relief.

513. Vaporizer houses shall not have drains to sewers or sump pits.

52. Vaporizers Not Directly Heated With Open Flames.

520. Vaporizers constructed in accordance with the requirements of the ASME Unfired Pressure Vessel Code shall be per-

manently marked as follows:

(a) With the code marking signifying the specifications to which vaporizer is constructed.

(b) With the allowable working pressure and temperature for which the vaporizer is designed.

(c) With the sum of the outside surface area and the inside heat exchange surface area expressed in square feet.

(d) With the name or symbol of the manufacturer, date of manufacture, and serial number.

521. Vaporizers having an inside diameter of 6 inches or less exempted by the ASME Unfired Pressure Vessel Code shall have a design working pressure not less than 250 pounds per square inch gauge and need not be permanently marked.

522. Vaporizers shall not be installed in the same room with units furnishing air other than for a liquefied petroleum gas mixing device. Vaporizers may be installed in buildings, rooms, sheds, or lean-tos, other than those in which open flames or fires may exist. Such structures shall be of light fire resistive construction or equivalent, well ventilated near the floor line and at the highest point in the roof.

523. A shutoff valve shall be installed on the liquid line to the liquefied petroleum gas vaporizer unit at least 50 feet away from the vaporizer building.

524. The heating medium lines into and leaving the vaporizer shall be provided with suitable means for preventing the flow of gas into the heat systems in the event of tube rupture in the vaporizer. Vaporizers shall be provided with suitable automatic means to prevent liquid passing from the vaporizers to the gas discharge piping.

525. The device that supplies the necessary heat for producing steam, hot water, or other heating medium shall be separated from all compartments or rooms containing liquefied petroleum gas vaporizers, pumps, and central gas mixing devices by a wall of substantially fire resistive material and vaportight construction.

53. Direct Fired Vaporizers.

530. Each vaporizer shall be marked to show the name of the manufacturer; rated British Thermal Unit input to burners;

the area of the heat exchange surface in square feet; and the maximum vaporizing capacity in gallons per hour, and date and serial number.

531. No direct fired vaporizers shall be located closer than 50 feet to line of adjoining property upon which structures may be built. They shall also be located a minimum distance of 50 feet away from any liquefied petroleum gas storage container.

532. No direct fired vaporizer shall be connected to a container that has a storage capacity in gallons, less than 10 times the hourly capacity of the vaporizer in gallons. Vaporizers may be connected to the liquid section or the gas section of the storage container, or both; but in any case there shall be at the container a manually operated valve in each connection to permit complete shutting off, when desired, all flow of gas or liquid from container to vaporizer.

533. Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. All vaporizer housing structures shall be of light fire resistive construction, well ventilated near the floor line and the highest point of the roof.

534. When vaporizers and mixing equipment are installed in structures that house other facilities, the vaporizers and mixing equipment room shall be separated from the other parts of the building with fire resistive, vaportight walls.

535. Vaporizers shall be provided with suitable automatic means to prevent liquid passing from the vaporizer to the gas discharge piping of the vaporizer.

536. Vaporizers shall be provided with a means for turning off the gas to the main burner and pilot from a remote location.

537. Vaporizers shall be equipped with automatic safety devices to shut off the flow of fuel to main burners and pilot, if the ignition device should fail.

538. Pressure control equipment which is a pertinent part of the vaporizer, if located within 10 feet of the vaporizer, shall be separated from the open flame by a substantial vaportight, fire resistive partition or partitions.

539. No direct fired vaporizer shall raise the product pressure over the designed working pressure of the vaporizer equipment.

SECTION 6. RELIEF DEVICES.

61. General.

610. Relief devices on containers shall be so arranged that the possibility of tampering will be minimized; if the pressure setting or adjustment is external, the relief devices shall be provided with an approved means for sealing the adjustment.

611. Each nonrefrigerated shop fabricated container relief device shall be plainly and permanently marked with the "Container Type," of the pressure vessel on which the device is designed to be installed, with the pressure in pounds per square inch gauge at which the device is set to start to discharge, with the actual rate of discharge of the device at its full open position in cubic feet per minute of air at 60 F. and atmospheric pressure, and with the manufacturer's name and catalogue number; for example, T-200—250–15,000 AIR — indicating that the device is suitable for use on a Type 200 container, that it is set to start to discharge at 250 pounds per square inch gauge, and that its rate of discharge at full open position is 15,000 cubic feet per minute of air. Each field erected nonrefrigerated and refrigerated container relief device shall be similarly marked except "Container Type" indication is not required.

612. The rate of discharge of container relief valves shall be in accordance with the provisions of Appendix A for nonrefrigerated containers and Appendix E for refrigerated containers.

613. Connections to which relief devices are attached, such as couplings, flanges, nozzles, and discharge lines for venting, shall have internal dimensions that will not restrict the net relief area.

614. The size of the relief device outlet connection shall not be smaller in diameter than the nominal size of the relief outlet connection and shall not appreciably restrict flow through the relief.

615. All container relief devices shall be located on the containers and shall be connected with the vapor space of the container.

616. No shutoff valve shall be installed between the relief device and the container, equipment, or piping to which the relief device is connected except that a shutoff valve may be used where the arrangement of this valve is such that full required

capacity flow through the relief device is always afforded.

NOTE: The above exception is made to cover such cases as a three-way valve installed under two relief devices, each of which has the required rate of discharge. The installation will allow either of the reliefs to be closed but does not allow both reliefs to be closed at the same time. Another exception to this may be where two separate reliefs are installed with individual shutoff valves. In this case the two shutoff valve stems shall be mechanically inter-connected in a manner which will allow full required flow of one relief at all times.

617. Relief device discharge vents shall be installed in a manner which will provide protection against physical damage and such discharge pipes shall be fitted with loose fitting rain caps. Return bends and restrictive pipe fittings shall not be permitted.

618. If desired, discharge lines from two or more relief devices located on the same unit, or similar lines from two or more different units, except those located on storage containers, may be run into a common discharge header provided the header is designed with a flow capacity sufficient to limit the maximum back pressure to (a) not exceeding 10% of the lowest start-to-discharge pressure setting for conventional relief valves, and (b) not exceeding 50% of the lowest start-to-discharge pressure setting for balanced valves. Header design shall assume that all valves connected to the header are discharging at the same time.

619. Discharge from a relief device shall not terminate in any building, beneath any building, or in any other kind of confined area. The discharge from all relief devices, except those installed between shutoff valves, shall be piped to a point not less than three feet above the highest point of any building within 50 feet.

62. Testing Relief Devices.

620. Frequent testing of relief devices, as would be required where there is a probable increase or decrease in the releasing pressure of the device due to clogging, sticking, corrosion or exposure to elevated temperatures, is not necessary for such devices on liquefied petroleum gas containers for the following reasons:

(a) The gases are so-called "sweet gases," i.e., they have no corrosive effect on metals; the devices are constructed of materials not readily subject to corrosion and are protected against the weather when installed in pressure vessels. Further, the temperature variations are not sufficient to bring about any permanent set of spring mechanisms.

(b) Therefore the testing and inspecting of relief devices to check relief pressure settings is required only at about five-year intervals.

63. On Aboveground Containers.

630. Every container shall be provided with spring loaded relief valves or their equivalent.

631. The discharge from the relief devices shall be vented away from the container, and unobstructed to the open air in a manner to prevent any impingement of escaping gas upon the container, adjacent containers, piping and other equipment. The vents shall be fitted with loose fitting rain caps. Suitable provision shall be made to prevent any liquid or condensate that may accumulate inside the relief device or its vent from rendering the relief device inoperative. If a bottom drain is used, a means shall be provided to protect the container, adjacent containers, piping of equipment against impingement of flame resulting from ignition of product escaping from the drain. The vent piping shall extend upward at least 7 feet above the top of the container.

632. Container relief devices shall be set to start to discharge as follows with relation to the design pressure or maximum allowable working pressure of the container as appropriate for the applicable code:

Containers	Minimum	Maximum*
ASME Code; Par. U-68, U-69—1949 and earlier editions	110%	125%
ASME Code; Par. U-200, U-201—1949 edition	88	100
ASME Code—1950, 1952, 1956 and 1959 editions	88	100
API-ASME Code—All editions	88	100
API Standard 620 (First Edition)		100
API Standard 650 (First Edition)		100

*Note: A plus tolerance of 10% is permitted.

633. Relief devices on containers shall be constructed to discharge at not less than the rates shown in Appendix A or E, before the pressure is in excess of 120 per cent of the maximum permitted start to discharge pressure setting of the devices.

634. In certain locations sufficiently sustained sun temperatures prevail which will require the use of a lower vapor pressure product to be stored or the use of a higher designed pres-

sure vessel in order to prevent the container relief device from opening as a result of these temperatures. As an alternative the containers may be protected by cooling devices such as water sprays, by shading, or other effective means.

635. For refrigerated storage, consideration shall be given to making proper provisions for vacuum conditions.

64. On Underground Containers.

640. Relief devices shall meet all the conditions outlined for Aboveground Containers except the rate of discharge for relief devices installed thereon may be reduced to a minimum of 30 per cent of the specified rate of discharge shown in Appendix A. The discharge pipe from safety relief devices shall extend directly, vertically upward at least 7 feet above the ground. If liquid product is placed in containers while they are not buried, these containers should be considered as aboveground containers.

641. Where there is a probability of the manhole or housing becoming flooded, the discharge from regulator vent lines should be above such water level. All manholes or housings shall be provided with ventilated louvers or their equivalent.

65. On Vaporizers.

650. Each vaporizer shall be provided with a relief device providing an effective rate of discharge in accordance with Appendix B.

651. Relief valves on direct fired vaporizers shall be located so that they shall not be subjected to temperatures in excess of 140 F. (See 61 for other requirements on relief devices.)

66. Between Shutoff Valves.

660. A relief device shall be installed between each pair of shutoff valves on liquefied petroleum gas liquid piping so as to relieve into a safe atmosphere. It is recommended that the start to discharge pressure of such relief devices be not in excess of 500 psig.

67. At Discharge of Final Stage Regulators.

670. When the discharge pressure from the final stage regulator is not more than 5 pounds, the low pressure side shall be equipped with a relief device, set to relieve at not less than two times, and not more than three times the discharge pressure but not more than 5 lbs. in excess of the discharge pressure. When the discharge pressure is more than 5 pounds, the relief shall be set to not less than 1¼ times and not more than two times the discharging pressure. Regulator breather vents shall be piped outside the building and equipped with insect-proof terminal screens.

SECTION 7. HANDLING.

71. Transfer of Liquids Within a Utility Plant.

710. Liquefied petroleum gas in liquid form may be transferred from tank cars, or tank trucks, or storage within a utility plant either by liquid pump or by pressure differential.

(a) Pumps and compressors used for transferring liquefied petroleum gas shall be designed for the product handled.

(b) Pressure differential for transferring liquid should be developed by a vapor compressor which takes suction from the vapor space of the liquefied petroleum gas container being filled and discharges into the vapor space of the container being emptied.

711. Under certain conditions, it may be necessary to create a pressure differential by using fuel gas, air, or inert gas, which is at a pressure higher than the pressure of the liquefied petroleum gas in the container being filled. This may be done under the following conditions:

(a) Adequate precautions must be taken to prevent liquefied petroleum gas from flowing back into the fuel gas, air, or inert gas line or system by installing two back flow check valves in series in these lines at the point where they connect into the liquefied petroleum gas system. In addition, a manually operated positive shutoff valve shall be installed at this point.

(b) Any fuel gas, air, or inert gas used to obtain a pressure differential to move liquid liquefied petroleum gas shall be noncorrosive and dried to avoid stoppage by freezing.

(c) If a fuel gas, air, or inert gas is used to obtain a pressure differential to move liquid liquefied petroleum gas, consideration should be given, after the operation is discontinued, to removing the fuel gas, air, or inert gas from the container into which it was placed, such as by venting. This should be done only if the vented gas can be conducted to a proper vent, preferably a distance from the plant and then properly disposed of.

(d) Before any fuel gas, air, or inert gas is placed in a tank car for unloading liquefied petroleum gas by pressure differential, permission should be obtained from the vendor of the liquefied petroleum gas to introduce such vapors into the tank car or a tank truck.

712. At least one attendant shall remain close to the transfer connection from the time the connections are first made until they are finally disconnected, during the transfer of product.

713. The maximum vapor pressure of the product at 100 F. which may be transferred into a container shall be in accordance with 220 or 221 and 222.

714. Where needed unloading piping or hoses shall be provided with suitable bleeder valves for relieving pressure before disconnection.

715. Precaution shall be exercised to assure that only those gases for which the system is designed, examined, and listed, are employed in its operation, particularly with regard to pressures.

72. Tank Car Loading and Unloading Point.

720. The track of tank car siding shall be relatively level.

721. A TANK CAR CONNECTED sign, as covered by I.C.C. (Interstate Commerce Commission)* rules, shall be installed at the active end or ends of the siding while the tank car is connected for unloading.

722. While cars are on side-track for unloading, the wheels at both ends shall be blocked on the rail.

*See Appendix G, page 59–48, for availability.

723. A man shall be in attendance at all times while the tank car or cars are being unloaded.

724. The pipe line to which the tank car unloading hoses are connected shall be equipped with a back flow check valve to prevent discharge of the liquefied petroleum gas from the receiving container and line in case of rupture of line hose or fittings.

725. The tank car unloading point should be located with due safety consideration to the following:

(a) Proximity to railroad and highway traffic.
(b) The distance of such unloading point from adjacent property.
(c) With respect to buildings on installer's property.
(d) Nature of occupancy.
(e) Topography.
(f) Type of construction of buildings.
(g) Number of tank cars that may be safely unloaded at one time.
(h) Frequency of unloading.

726. Where practical, the distance of the tank car unloading point should conform to the distance in 240 except that lesser distances may be used, keeping in mind the above items and upon approval of the authority having jurisdiction.

SECTION 8. FIRE PROTECTION.

81. Fire Protection.

810. The wide range in the size, design, and location of utility plant liquefied petroleum gas installations makes the recommendations of any specific kind or method of fire protection impractical. The planning of effective fire protection should initially be coordinated with the protection practices followed in other sections of the particular utility company and should give due consideration to the requirements of the authority having jurisdiction.

811. Gas fires should not be extinguished until the source of the burning gas can be shut off. Remotely operated or remotely located pipe line valves may be advantageously used for fire control under many circumstances (see 435, 437 and 523).

812. Hand or wheeled fire extinguishers designed for gas fires, preferably of the dry chemical type, should be available at each strategic location within a liquefied petroleum gas plant.

813. Supplies of water may be utilized through hose lines preferably equipped with combination (spray and straight stream) nozzles to permit widest adaptability in fire control. If sufficient quantities of water can be made available, complete water spray protection can be given consideration. The water is used for the sole purpose of cooling equipment, foundations, and piping. It shall not be relied upon for extinguishing gas fires.

814. Fire-resistive insulation may be utilized for protecting metal against heat. Care in selecting and applying such insulation is necessary since effectiveness is dependent on its ability to stay in place on a container during a fire.

815. Where standard watchman service is provided it shall be extended to the liquefied petroleum gas installation; such personnel shall be properly trained.

816. Suitable roadways or means of access shall be provided for extinguishing equipment such as wheeled extinguishers or other fire department apparatus.

817. Routine fire drills and inspections should be scheduled and operating personnel thoroughly trained in the use of available fire-fighting equipment and the location and use of all gas and liquid piping and valves.

APPENDIX A.

Minimum Required Rate of Discharge in cubic feet per minute of air at 120% of the maximum permitted start to discharge pressure for safety relief devices to be used on nonrefrigerated containers other than those constructed in accordance with Interstate Commerce Commission specifications.

Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air	Surface Area Sq. Ft.	Flow Rate CFM Air
20 or less	625	170	3620	600	10170
25	751	175	3700	650	10860
30	872	180	3790	700	11550
35	990	185	3880	750	12220
40	1100	190	3960	800	12880
45	1220	195	4050	850	13540
50	1330	200	4130	900	14190
55	1430	210	4300	950	14830
60	1540	220	4470	1000	15470
65	1640	230	4630	1050	16100
70	1750	240	4800	1100	16720
75	1850	250	4960	1150	17350
80	1950	260	5130	1200	17960
85	2050	270	5290	1250	18570
90	2150	280	5450	1300	19180
95	2240	290	5610	1350	19780
100	2340	300	5760	1400	20380
105	2440	310	5920	1450	20980
110	2530	320	6080	1500	21570
115	2630	330	6230	1550	22160
120	2720	340	6390	1600	22740
125	2810	350	6540	1650	23320
130	2900	360	6690	1700	23900
135	2990	370	6840	1750	24470
140	3080	380	7000	1800	25050
145	3170	390	7150	1850	25620
150	3260	400	7300	1900	26180
155	3350	450	8040	1950	26750
160	3440	500	8760	2000	27310
165	3530	550	9470		

Surface Area = Total outside surface area of container in square feet.

When the surface area is not stamped on the name plate or when the marking is not legible, the area can be calculated by using one of the following formulas:

(1) Cylindrical container with hemispherical heads
Area = Overall length × outside diameter × 3.1416

(2) Cylindrical container with semi-ellipsoidal heads
Area = (Overall length + .3 outside diameter) × outside diameter × 3.1416

(3) Spherical container
Area = Outside diameter squared × 3.1416