

58

STORAGE AND HANDLING
**LIQUEFIED
PETROLEUM
GASES**
1967

~~FLORIDA REGULATIONS~~
~~BROWNE WILLIAMS~~
STATE TREASURER
AND INSURANCE
COMMISSIONER

SEP 1968



Seventy-five Cents

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NATIONAL FIRE PROTECTION ASSOCIATION
International

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Official NFPA Definitions

Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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

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. One pound = 453.6 grams.

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Standard for the Storage and Handling of Liquefied Petroleum Gases

NFPA No. 58 — 1967

1967 Edition of No. 58

This edition supersedes the 1965 edition. The 1967 edition was adopted at the NFPA Annual Meeting on May 17, 1967.

The 1967 edition has been submitted to the United States of America Standards Institute for approval as a USA Standard as of the date of publication. The 1965 edition was approved and designated ASA Z106.1 — 1965, UDC 621.6.036.

Major changes are addition of material on electrical equipment in certain areas in B.18, and complete revision of Divisions VI and VII. Other changes are indicated by a vertical line in the margins of the pages in which they appear.

Origin and Development of No. 58

The first NFPA Standard on LP-Gas was adopted in 1932. In the next 8 years, separate standards covering various LP-Gas applications were adopted. In 1940, several standards were combined and adopted as NFPA No. 58.

Revisions of NFPA No. 58 were adopted in 1943, 1946, 1948, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1963 and 1965 as recommended by the Committee on Gases.

The Committee on Liquefied Petroleum Gases assumed responsibility for NFPA No. 58 with its formation in June, 1966.

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SCOPE: To develop fire safety codes, standards, recommended practices, and manuals, as may be considered desirable, covering the design, construction, installation and operation of fixed and portable liquefied petroleum gas systems in bulk plants, in domestic, commercial, industrial (with specified exceptions), institutional, and similar properties; truck transportation of liquefied petroleum gas; engine fuel systems on motor vehicles and other mobile equipment; storage of containers awaiting use or resale; installations on mobile homes, travel trailers and commercial vehicles; and installations at liquefied petroleum gas service stations.

Interpretation Procedure of the Committee on LP-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, Mass. 02110.

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Standard for the Storage and Handling of Liquefied Petroleum Gases

NFPA No. 58 — 1967

INTRODUCTION.

I.1. The terms “liquefied petroleum gases,” “LPG” and “LP-Gas” 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 iso-butane), and butylenes.

(a) 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 handling, distribution and operation.

(b) Under moderate pressure the gases liquefy, but upon release of the pressure are readily converted into the gaseous phase. Advantage of this characteristic is taken by the industry, and for convenience the gases are shipped and stored under pressure as liquids. When in the gaseous state, these gases present a hazard comparable to any flammable natural or manufactured gas, except that being heavier than air, ventilation requires added attention. The range of combustibility is considerably narrower and lower than that of natural or manufactured gas.

(c) 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.

(d) Rapid vaporization takes place at temperatures above the boiling points (normal butane about 31 F., propane about minus 44 F.). Normal storage of these gases is as a liquid under pressure.

(e) ON APRIL 1, 1967, CERTAIN FUNCTIONS OF THE U.S. INTERSTATE COMMERCE COMMISSION (ICC) WERE TRANSFERRED TO THE U. S. DEPARTMENT OF TRANSPORTATION (DOT). IT IS ANTICIPATED THAT THE ICC REGULATIONS AND SPECIFICATIONS EXISTING AS OF APRIL 1, 1967 AND REFERENCED IN THIS STANDARD WILL BE REPLACED WITH DEPARTMENT OF TRANSPORTATION (DOT) REGULATIONS AND SPECIFICATIONS.

I.2. Application of Standard

(a) This standard applies to the design, construction, location, and operation of liquefied petroleum gas installations covered in I.2(a)1 through 9.

1. “Basic Rules” apply to all divisions except Division V, and unless noted in “Basic Rules.”

2. Division I — “bottled gas” — applies to installations utilizing containers constructed in accordance with Interstate Commerce Commission specifications.*

3. Division II applies to installations utilizing containers other than those constructed in accordance with Interstate Commerce Commission specifications.*

4. Division III applies to containers and pertinent equipment mounted on trucks, semi-trailers and trailers used for the transportation of liquefied petroleum gases.

5. Division IV applies to fuel containers for the use of liquefied petroleum gases as motor fuel; or with easily movable, readily portable or self-propelled internal combustion engines (*i.e.*, highway vehicles, trucks, buses, tractors, automobiles, etc.; farm machinery, construction and miscellaneous machinery; industrial plant tractors, locomotives, similar mobile or semi-mobile units; etc.).

6. Division V applies to the storage of containers awaiting use or resale.

7. Division VI applies to exchangeable, readily portable container systems for cooking, heating and refrigerating installations in mobile homes, travel trailers, camper trailers or self-propelled campers.

8. Division VII applies to LP-Gas systems installed on commercial vehicles, and certain self-propelled or trailer-type mobile living units.

9. Division VIII applies to liquefied petroleum gas service stations where fuel is dispensed into containers of self-propelled internal combustion engines complying with Division IV.

(b) This standard does not apply to:

1. Marine or pipeline terminals, natural gasoline plants, refineries or tank farms, where tank farms do not include storage located in industrial locations.

2. Chemical plants where specific approval of construction and installation plans is obtained from the authority having jurisdiction, provided such approval is based on substantially equivalent requirements.

*See I.1.(e).

3. LP-Gas refrigerated storage systems.
4. LP-Gas when used with oxygen. The Standard for the Installation and Operation of Oxygen-Fuel Gas Systems for Welding and Cutting, NFPA No. 51, shall apply.
5. LP-Gas when used in utility gas plants. The Standard for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants, NFPA No. 59, shall apply.

(c) This standard does not apply to low pressure (not in excess of $\frac{1}{2}$ pound per square inch or 14 inches water column) LP-Gas piping systems and the installation and operation of residential and commercial appliances, including their inlet connections, supplied through such systems. For details of such systems, see the Standard for the Installation of Gas Appliances and Gas Piping, NFPA No. 54, which shall apply. See Division VI for systems on mobile homes, travel trailers, camper trailers or self-propelled campers.

I.3. Definitions:

(a) CONTAINER ASSEMBLY. An assembly consisting essentially of the container and fittings for all container openings, including shutoff valves, excess flow valves, liquid level gaging devices, safety relief devices and protective housings.

(b) CONTAINERS. All vessels, such as tanks, cylinders or drums, used for transportation or storing liquefied petroleum gases.

(c) GALLONS. U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 231 cubic inches = 3.785 liters.

(d) GAS. Liquefied petroleum gases in either the liquid or gaseous state.

(e) ICC. The Interstate Commerce Commission. See I.1.(e).

(f) MOVABLE FUEL STORAGE TENDERS or FARM CARTS. Containers not in excess of 1,200 gallons water capacity, equipped with wheels to be towed from one location of usage to another. They are basically nonhighway vehicles, but may occasionally be moved over public roads or highways. They are used as a fuel supply for farm tractors, construction machinery and similar equipment.

(g) PSIG and PSIA. Pounds per square inch gage and pounds per square inch absolute, respectively.

(h) SYSTEMS. An assembly of equipment consisting essentially of the container or containers, major devices such as vaporizers, safety relief valves, excess flow valves, regulators, and piping connecting such parts.

(i) VAPORIZER-BURNER. An integral vaporizer-burner unit, dependent upon the heat generated by the burner as the source of heat to vaporize the liquid used for dehydrators or dryers.

(j) **VENTILATION, ADEQUATE.** When specified for the prevention of fire during normal operation, ventilation shall be considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25 per cent of the lower flammable limit.

I.4. Submittal of Plans

(a) For industrial installations utilizing storage containers of over 2,000 gallons water capacity, plans shall be submitted to the authority having jurisdiction before construction.

BASIC RULES.

B.1. Odorizing Gases

(a) All liquefied petroleum gases shall be effectively odorized by an approved agent of such character as to indicate positively, by distinct odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of flammability. Odorization, however, 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 flammable limits of the more commonly used LP-Gases are: Propane, 2.15 per cent; Butane, 1.55 per cent. These figures represent volumetric percentages of gas in gas-air mixtures.

(b) The odorization requirement of B.1 (a) shall be considered to be met by the use of 1.0 pounds of ethyl mercaptan, 1.0 pounds of thiophane 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 B.1 (a).

B.2. Approval of Equipment and Systems

(a) Each system utilizing ICC* containers shall have its container valves, connectors, manifold valve assemblies, and regulators (bases, hoods or cabinets if desired):

1. Listed by Underwriters' Laboratories, Inc., or,
2. Listed by a nationally recognized testing laboratory, or,
3. Inspected and approved by the authority having jurisdiction.

(b) Each system for domestic or commercial use utilizing containers of 2,000 gallons or less water capacity, other than those constructed in accordance with ICC* specifications, shall consist of a container assembly and one or more regulators, and may include other parts. The system as a unit or the container assembly as a unit, and the regulator or regulators, shall be individually:

1. Listed by Underwriters' Laboratories, Inc., or,
2. Listed by a nationally recognized testing laboratory, or,

*See I.1.(c).

3. Inspected and approved by the authority having jurisdiction.

NOTE: Where necessary to alter, or to repair such listed systems in the field in order to provide for different operating pressures, change from vapor to liquid withdrawal, and the like, such changes may be made by use of component parts which have been individually listed by one of the above for use with LP-Gas.

(c) In systems utilizing containers of over 2,000 gallons water capacity, each regulator, container valve, excess flow valve, gaging device and relief valve installed on or at the container, shall have its correctness as to design, construction, and performance determined by:

1. Listing by Underwriters' Laboratories, Inc., or,
2. Listing by a nationally recognized testing laboratory, or,
3. Inspected and approved by the authority having jurisdiction.

B.3. Requirement for Construction and Original Test of Containers

(a) Containers used with systems embodied in Divisions II, III, IV, VI, VII, and VIII, except as provided in 4.2(c), 6.1(a) and 7.1(a), 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 are in substantial conformity with the rules of the ASME Code or the API-ASME Code. Adherence to applicable ASME Code Case Interpretations and Addenda shall be considered as compliance with the ASME Code.

1. Containers constructed according to the 1949 and earlier editions of the ASME Code do not have to comply with paragraphs U-2 to U-10 inclusive and U-19. Containers constructed according to paragraph U-70 in the 1949 and earlier editions are not authorized.

*API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases (1951 edition with 1954 Addenda), or Rules for Construction of Unfired Pressure Vessels, Section VIII, ASME Boiler and Pressure Vessel Code (1965 edition). Available from the American Society of Mechanical Engineers, 345 East 47th St., New York, New York 10017.

**Construction of containers under the API-ASME Code is not authorized after July 1, 1961.

2. Containers constructed according to API-ASME Code do not have to comply with Section I or with appendix to Section I. Paragraphs W-601 to W-606 inclusive in the 1943 and earlier editions do not apply.

(b) The provisions of paragraph B.3(a) shall not be construed as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the standards established for the Storage and Handling of Liquefied Petroleum Gases (No. 58) in effect at the time of fabrication.

(c) Containers used with systems embodied in Division I, in 4.2(c) of Division IV, in Division VI [except as provided in 6.1(b)], and in Division VII [except as provided in 7.1(b)], shall be constructed, tested and stamped in accordance with Interstate Commerce Commission Specifications* effective at the date of their manufacture.

B.4. Welding on Containers

(a) Welding to the shell, head, or any other part of the container subject to internal pressure, shall be done in compliance with the code under which the tank was fabricated. Other welding is permitted only on saddle plates, lugs or brackets attached to the container by the tank manufacturer.

(b) Where repair or modification involving welding of ICC* containers is required, the container shall be returned to a qualified manufacturer making containers of the same type, and the repair or modification made in compliance with ICC* regulations.

B.5. Markings on Containers

(a) Each container covered in B.3(a), except as provided in B.3(b), shall be marked as specified in the following:

1. 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 and Pressure Vessel Inspectors.

*Regulations of the U. S. Interstate Commerce Commission (See I.1.(e)) outline specifications for transportation of explosives and dangerous articles (Federal Code of Regulations — Title 49 — Parts 171-190). Available from Government Printing Office, Washington, D. C. or from the Bureau of Explosives, 63 Vesey St., New York, N. Y. In Canada, the regulations of the Board of Transport Commissioners for Canada apply. Available from BTC, Union Station, Ottawa, Ontario.

2. With notation as to whether container is designed for underground or aboveground installation or both. If intended for both and different style hoods are provided, the marking shall indicate the proper hood for each type of installation.

3. With the name and address of the supplier of the container, or with the trade name of the container.

4. With the water capacity of the container in pounds or gallons, U. S. Standard.

5. With the pressure in psig, for which the container is designed.

6. With the wording "This container shall not contain a product having a vapor pressure in excess of — psig at 100 F." See Par. B.14(i).

7. With the tare weight in pounds or other identified unit of weight for containers with a water capacity of 300 pounds or less.

8. 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 or which are filled by weighing. Markings shall be in increments of not more than 20 F. This marking may be located on liquid level gaging device.

9. With the outside surface area in square feet.

(b) Markings specified shall be on a metal nameplate attached to the container and located in such a manner as to remain visible after the container is installed.

(c) When LP-Gas and one or more other gases are stored or used in the same area, the containers shall be marked to identify their content. Marking shall be in compliance with USA Standard Z48.1 — 1954, "Method of Marking Portable Compressed Gas Containers to Identify the Material Contained."*

B.6. Location of Containers and Regulating Equipment

(a) Containers, and first stage regulating equipment if used, shall be located outside of buildings, except under one or more of the following:

1. In buildings used exclusively for container charging, vaporization, pressure reduction, gas mixing, gas manufacturing or distribution.

*Available from Compressed Gas Association, Inc., 500 Fifth Avenue, New York, New York 10036.

2. When portable use is necessary and in accordance with 1.4.
3. LP-Gas tank vehicles parked or garaged in accordance with 3.21.
4. LP-Gas fueled stationary or portable engines in accordance with 4.10 or 4.11.
5. LP-Gas fueled industrial trucks used in accordance with 4.12.
6. LP-Gas fueled vehicles garaged in accordance with 4.13.
7. Containers awaiting use or resale when stored in accordance with Division V.

(b) Each individual container shall be located with respect to the nearest important building or group of buildings or line of adjoining property which may be built on in accordance with Table 1:

Table 1

Water Capacity per Container	Minimum Distances		
	Containers		Between Aboveground Containers
	Under-ground	Above-ground	
Less than 125 gallons	10 feet	None	None
125 to 500 gallons	10 feet	10 feet	3 feet
501 to 2,000 gallons	25 feet*	25 feet*	3 feet
2,001 to 30,000 gallons	50 feet	50 feet	5 feet
30,001 to 70,000 gallons	50 feet	75 feet	¼ of sum of diameters of adjacent containers
70,001 to 90,000 gallons	50 feet	100 feet	

*NOTE: The above distance requirements may be reduced to not less than 10 feet for a single container of 1,200 gallons water capacity or less, providing such a container is at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.

(c) Containers installed for use shall not be stacked one above the other.

(d) In cases of bulk storage in heavily populated or congested areas, the authority having jurisdiction shall determine restrictions of individual tank capacity, total storage, and distance to line of adjoining property which may be built on and other reasonable protective methods.

NOTE: Generally, aggregate storage of 2,000 gallons water capacity or more is considered bulk storage within the intent of B.6(d).

(e) In industrial installations involving containers of 180,000 gallons aggregate water capacity or more, where serious mutual exposures between the container and adjacent properties prevail, the authority having jurisdiction may require fire walls or other means of special protection designed and constructed in accordance with good engineering practices.

(f) In the case of buildings devoted exclusively to gas manufacturing and distributing operations, the above distances may be reduced provided that in no case shall containers of water capacity exceeding 500 gallons be located closer than 10 feet to such gas manufacturing and distributing buildings.

(g) Readily ignitable material such as weeds and long dry grass shall be removed within ten feet of any container.

(h) The minimum separation between liquefied petroleum gas containers and flammable liquid tanks shall be 20 feet, and the minimum separation between a container and the center line of the dike shall be 10 feet. The foregoing provision shall not apply when LP-Gas containers of 125 gallons or less capacity are installed adjacent to Class III flammable liquid tanks of 275 gallons or less capacity.

(i) Suitable means shall be taken to prevent the accumulation of flammable liquids under adjacent liquefied petroleum gas containers, such as by diking, diversion curbs or grading.

(j) When dikes are used with flammable liquid tanks, no liquefied petroleum gas containers shall be located within the diked area.

B.7. Container Valves and Container Accessories.

(a) Valves, fittings and accessories connected directly to the container including primary shutoff valves, shall have a rated working pressure of at least 250 psig and shall be of material and design suitable for LP-Gas service. Cast iron shall not be used for container valves, fittings, and accessories. This does not prohibit the use of container valves made of malleable or nodular iron*.

(b) Connections to containers, except safety relief connections, liquid level gaging devices and plugged openings, shall have shutoff valves located as close to the container as practicable.

*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 (A47-61 or A395-61), 1916 Race St., Philadelphia, Pa. 19103.

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

(d) Liquid level gaging devices which are so constructed that outward flow of container contents shall not exceed that passed by a No. 54 drill size opening, need not be equipped with excess flow valves.

(e) Openings from container or through fittings attached directly on container to which pressure gage connection is made, need not be equipped with shutoff or excess flow valves if such openings are restricted to not larger than No. 54 drill size opening.

(f) Except as provided in 1.4(a)2, 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 manner that any undue strain beyond the excess flow or back pressure check valve will not cause breakage between the container and such valve. (See Div. III for tank truck requirements.)

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

(h) Containers of more than 30 gallons water capacity and less than 2,000 gallons water capacity, filled on a volumetric basis, and manufactured after December 1, 1963 shall be equipped for filling into the vapor space.

B.8. Piping — including Pipe, Tubing and Fittings

(a) Pipe, except as provided in 3.3(c), 4.5(a), 6.9(c) and 7.9(c), shall be wrought iron or steel (black or galvanized), brass, copper, or aluminum alloy. Aluminum alloy pipe shall be at least Schedule 40 in accordance with USA Standard Specification for Aluminum Alloy Pipe, H 38.7 (ASTM B-241), (except that the use of alloy 5456 is prohibited) and shall be suitably marked at each end of each length indicating compliance with USA Standard Specifications. Aluminum alloy pipe shall be protected against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by such liquids as water (except rain water) detergents, sewage or leaking from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maxi-

imum nominal pipe size for aluminum pipe shall be $\frac{3}{4}$ inch and shall not be used for pressures exceeding 20 psig. Aluminum alloy pipe shall not be installed within 6 inches of the ground.

1. Vapor piping with operating pressures not exceeding 125 psig shall be suitable for a working pressure of at least 125 psig. Pipe shall be at least Schedule 40 (ASTM A-53, Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal).

2. Vapor piping with operating pressures over 125 psig and all liquid piping shall be suitable for a working pressure of at least 250 psig. Pipe shall be at least Schedule 80 if joints are threaded, or threaded and back welded. At least Schedule 40 (ASTM A-53 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal) shall be used if joints are welded, or welded and flanged.

(b) Tubing shall be seamless and of copper, brass, steel or aluminum alloy. Copper tubing shall be of type K or L or equivalent as covered in USA Standard Specification for Seamless Copper Water Tube, H 23.1 (ASTM B-88). Aluminum alloy tubing shall be of Type A or B or equivalent as covered in Specification ASTM B-307 and shall be suitably marked every 18 inches indicating compliance with ASTM Specifications. The minimum nominal wall thickness of copper tubing and aluminum alloy tubing shall be as specified in Table G-1 and Table G-2 of Appendix G.

Aluminum alloy tubing shall be protected against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by liquids such as water (except rain water), detergents, sewage or leakage from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum outside diameter for aluminum alloy tubing shall be $\frac{3}{4}$ inch and shall not be used for pressures exceeding 20 psig. Aluminum alloy tubing shall not be installed within six inches of the ground.

(c) In systems where the gas in liquid form without pressure reduction enters the building [see B.13(a)] only heavy walled seamless brass or copper tubing with an internal diameter not greater than $\frac{3}{32}$ inch, and a wall thickness of not less than $\frac{3}{64}$ inch shall be used. This requirement shall not apply to research and experimental laboratories, buildings or separate fire divisions of buildings used exclusively for housing internal combustion engines, and to commercial gas plants or bulk stations where containers are charged, nor to industrial vaporizer buildings.

(d) Pipe joints may be screwed, flanged, welded, soldered or

brazed with a material having a melting point exceeding 1,000 F. Joints on seamless copper, brass, steel or aluminum alloy gas tubing shall be made by means of approved gas tubing fittings, or soldered or brazed with a material having a melting point exceeding 1,000 F.

(e) For operating pressures of 125 psig or less, fittings shall be designed for a pressure of at least 125 psig, except for tank truck requirements, see 3.3(b). For operating pressures above 125 psig, fittings shall be designed for a minimum of 250 psig.

(f) The use of threaded cast iron pipe fittings such as ells, tees, crosses, couplings and unions is prohibited. Aluminum alloy fittings shall be used with aluminum alloy pipe and tubing. Insulated fittings shall be used where aluminum alloy pipe or tubing connects with a dissimilar metal.

(g) Strainers, regulators, meters, compressors, pumps, etc., are not to be considered as pipe fittings. This does not prohibit the use of malleable, nodular or higher strength gray iron for such equipment*.

(h) All materials such as valve seats, packing, gaskets, diaphragms, etc., shall be of such quality as to be resistant to the action of liquefied petroleum gas under the service conditions to which they are subjected.

(i) All piping, tubing, or hose shall be tested after assembly and proved free from leaks at not less than normal operating pressures. After installation, piping and tubing of all domestic and commercial systems shall be tested and proved free of leaks using a manometer or equivalent device that will indicate a drop in pressure. Test shall not be made with a flame.

(j) Provision shall be made to compensate for expansion, contraction, jarring and vibration, and for settling. This may be accomplished by flexible connections.

(k) Piping outside buildings may be buried, aboveground, or both, but shall be well supported and protected against physical damage. Where soil conditions warrant, all piping shall be protected against corrosion. Where condensation may occur, the piping shall be pitched back to the container, or suitable means shall be provided for revaporization of the condensate.

* For information as to the suitability of malleable, nodular or high strength gray iron for use, refer to Standards of the American Society for Testing and Materials (A47-61, A395-61, or A126-42 Class B or C), 1916 Race St., Philadelphia, Pa. 19103.

B.9. Hose Specifications

(a) Hose shall be fabricated of materials that are resistant to the action of LP-Gas in the liquid and vapor phases. If wire braid is used for reinforcing the hose, it shall be of corrosion-resistant material such as stainless steel.

(b) Hose subject to container pressure shall be marked “LP-Gas” or “LPG” at not greater than 10 foot intervals.

(c) Hose subject to container pressure shall be designed for a bursting pressure of not less than 1,250 psig.

(d) Hose subject to container pressure shall have its correctness as to design construction and performance determined by:

1. Listing by Underwriters’ Laboratories, Inc., or
2. Listing by a nationally recognized testing laboratory, or
3. Approval by the authority having jurisdiction.

(e) Hose connections subject to container pressure shall be capable of withstanding, without leakage, a test pressure of not less than 500 psig.

(f) Hose and hose connections on the low pressure side of the regulator or reducing valve shall be designed for a bursting pressure of not less than 125 psig or five times the set pressure of the relief devices protecting that portion of the system, whichever is higher.

(g) Hose may be used on the low pressure side of regulators to connect to other than domestic and commercial gas appliances under the following conditions:

1. The appliances connected with hose shall be portable and need a flexible connection.

2. The hose shall be of minimum length, but shall not exceed 6 feet [except as provided in 1.4(a)7], and shall not extend from one room to another, nor pass through any walls, partitions, ceilings or floors. Such hose shall not be concealed from view or used in a concealed location.

3. The hose shall be approved and shall not be used where it is likely to be subjected to temperatures above 125 F. The hose shall be securely connected to the appliance and the use of rubber slip ends shall not be permitted.

4. The shutoff valve for an appliance connected by hose shall be in the metal pipe or tubing and not at the appliance end of the hose. When shutoff valves are installed close to each other, precautions shall be taken to prevent operation of the wrong valve.

5. Hose used for connecting to wall outlets shall be protected from physical damage.

B.10. Safety Devices

(a) Every container except those constructed in accordance with ICC** specifications and every vaporizer [except motor fuel vaporizers and except vaporizers described in B.11(b)3 and 2.3(e)1] whether heated by artificial means or not, shall be provided with one or more safety relief valves of spring-loaded or equivalent type. These valves shall be arranged to afford free vent to the outer air with discharge not less than 5 feet horizontally away from any opening into the building which is below such discharge. The rate of the discharge shall be in accordance with the provisions of Appendix A, or Appendix B in the case of vaporizers.

(b) Container and vaporizer safety relief valves shall be set to start-to-discharge, with relation to the design pressure of the container, in accordance with Table 2.

Table 2

<i>Containers</i>	<i>Minimum</i>	<i>Maximum</i>
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, 1959, 1962 and 1965 editions	88 %	100 %*
API — ASME Code — all editions.	88 %	100 %*
ICC**	As approved by Bureau of Explosives	

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

(c) Safety relief devices used with systems employing containers other than those constructed according to ICC** specifications shall be so constructed as to discharge at not less than the rates shown in Appendix A, before the pressure is in excess of 120 per cent of the maximum [not including the 10 per cent referred to in B.10(b)] permitted start to discharge pressure setting of the device:

(d) In certain locations sufficiently sustained high temperatures prevail which will require the use of a lower vapor pressure product to be stored or the use of a higher designed pressure vessel in order to prevent the safety valves opening as the result of these temperatures. As an alternative the tanks may be protected by cooling devices such as by spraying, by shading or other effective means.

(e) Safety relief valves shall be arranged so that the possibility of tampering will be minimized. If pressure setting or adjustment is external, the relief valves shall be provided with approved means for sealing adjustment.

**See I.1.(e).

(f) Shutoff valves shall not be installed between the safety relief devices and the container, or the equipment or piping to which the safety 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 safety relief device is always afforded.

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

(g) Safety relief valves shall have direct communication with the vapor space of the container at all times except as permitted in 3.18(a)1.

(h) Each container safety relief valve used with systems covered by Divisions II, III, IV, VI, VII and VIII, except as provided in 4.2(c) and 6.1(a), shall be plainly and permanently marked with the following: "Container Type" of the pressure vessel on which the valve is designed to be installed; the pressure in psig at which the valve is set to discharge; the actual rate of discharge of the valve in cubic feet per minute of air at 60 F. and 14.7 psia; and the manufacturer's name and catalogue number, for example: T200-250-4050 AIR — indicating that the valve is suitable for use on a Type 200 container, that it is set to start to discharge at 250 psig; and that its rate of discharge [see B.10(b) and (c)] is 4,050 cubic feet per minute of air as determined in Appendix A.

NOTE 1: Valves not marked "Air" are flow rated in LP-Gas and can be converted to their air capacity ratings by applying the air conversion factors given in the table following Appendix A.

NOTE 2: Frequent testing of safety relieve valves, as would be required where there is a probable increase or decrease of the releasing pressure of the valve due to clogging, sticking, corrosion or exposure to elevated temperatures, is not necessary for such valves 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 the metal of the container or valve; the valves are constructed of materials not readily subject to corrosion and are installed in pressure vessels so as to be protected against the weather. Further, the temperature variations are not sufficient to bring about any permanent set of the valve springs. Another reason is that the gases are odorized and instant warning is given of any escape of gas. Although general storage of these gases has been on a widespread scale for more than 20 years, industry experience has not shown any case of these safety valves not functioning properly.

(b) It is recognized, however, that like all mechanical devices, these valves cannot be expected to remain in reliable operative condition for-

ever, hence it is suggested that in the case of containers exceeding 2,000 gallons water capacity, they be tested at approximately 5-year intervals. When valve is of type necessitating removal for testing, container must first be emptied. When type of valve permits, testing may be accomplished by an external lifting device equipped with an indicator to show the pressure equivalent at which it opens.

(i) Safety relief valve assemblies, including their connections, shall be of sufficient size so as to provide the rate of flow required for the container on which they are installed.

(j) A hydrostatic relief valve shall be installed between each pair of shutoff valves on liquefied petroleum gas liquid piping so as to relieve into a safe atmosphere. The start-to-discharge pressure setting of such relief valves shall not be in excess of 500 psig. The minimum setting on relief valves installed in piping connected to other than ICC* containers shall not be lower than 140 per cent of the container relief valve setting and in piping connected to ICC* containers not lower than 400 psig. Such a relief valve should not be installed in the pump discharge piping if the same protection can be provided by installing the relief valve in the suction piping. The start-to-discharge pressure setting of such a relief valve, if installed on the discharge side of a pump, shall be greater than the maximum pressure permitted by the recirculation device in the system.

(k) The discharge from any safety relief device shall not terminate in or beneath any building, except relief devices covered by B.6(a)1 through 6, 1.3(a), or 1.4.

B.11. Vaporizer and Housing

NOTE: B.11 does not apply to motor fuel vaporizers (see Division IV, 4.7), nor to integral vaporizer-burners used for such purposes as weed burners or tar kettles.

(a) Indirect fired vaporizers utilizing steam, water or other heating medium shall be constructed and installed as follows:

1. Vaporizers shall be constructed in accordance with the requirements of the ASME Unfired Pressure Vessel Code or API-ASME Unfired Pressure Vessel Code and shall be permanently marked as follows:

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

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

*See I.1.(e).

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

With the name or symbol of the manufacturer.

2. Vaporizers having an inside diameter of 6 inches or less exempted by the ASME Unfired Pressure Vessel Code shall have a design pressure not less than 250 psig and need not be permanently marked.

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

4. Vaporizers may be installed in buildings, rooms, sheds, or lean-tos used exclusively for gas manufacturing or distribution, or in other structures of light, noncombustible construction or equivalent, well ventilated near the floor line and roof.

5. Vaporizers shall have at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with Appendix B, except as provided in 2.3(e)(1).

6. 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 through the vaporizers to the gas discharge piping.

7. The device that supplies the necessary heat for producing steam, hot water, or other heating medium may be installed in a building, compartment, room or lean-to which shall be ventilated near the floor line and roof to the outside. This device location 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 resistant material and vaportight construction. This requirement does not apply to the domestic water heaters which may supply heat for a vaporizer in a domestic system.

8. Gas-fired heating systems supplying heat exclusively for vaporization purposes shall be equipped with automatic safety devices to shut off the flow of gas to main burners, if pilot light should fail.

9. Vaporizers may be an integral part of a fuel storage container directly connected to the liquid section or gas section or both.

10. Vaporizers shall not be equipped with fusible plugs.

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

(b) Atmospheric vaporizers employing heat from the ground or surrounding air shall be installed as follows:

1. Buried underground, or

2. Located inside building close to a point at which pipe enters the building provided capacity of unit does not exceed one quart.

3. Vaporizers of less than one quart capacity heated by the ground or surrounding air, need not be equipped with safety relief valves provided that adequate tests certified by any of the authorities listed in B.2 demonstrate that the assembly is safe without safety relief valves.

4. Vaporizers designed primarily for domestic service shall be protected against tampering and physical damage.

(c) Direct gas-fired vaporizers shall be constructed, marked, and installed as follows:

1. (a) With the requirements of the ASME Code that are applicable to the maximum working conditions for which the vaporizer is designed. (See B.3.)

(b) With the name of the manufacturer; rated Btu input to the burner; the area of the heat exchange surface in square feet; the outside surface of the vaporizer in square feet; and the maximum vaporizing capacity in gallons per hour.

2. (a) 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 completely shutting off when desired, of all flow of gas or liquid from container to vaporizer.

(b) Vaporizers with capacity not exceeding 35 gallons per hour shall be located at least 5 feet from container shutoff valves. Vaporizers having capacity of more than 35 gallons but not exceeding 100 gallons per hour shall be located at least 10 feet from the container shutoff valves. Vaporizers having a capacity greater than 100 gallons per hour shall be located at least 15 feet from container shutoff valves.

3. Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. Vaporizing housing structures shall be of noncombustible construction, well ventilated near the floor line and the highest point of the roof. See B.10(a) for venting of relief valves.

4. Vaporizers shall have at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with Appendix B. Relief valve shall be so located as not to be subjected to temperatures in excess of 140 F.

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

6. Vaporizers shall be provided with means for manually turning off the gas to the main burner and pilot.

7. Vaporizers shall be equipped with automatic safety devices to shut off the flow of gas to main burners if pilot light should fail. When flow through pilot exceeds 2,000 Btu per hour, the pilot also shall be equipped with automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

8. Pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired vaporizer shall be separated from the open flame by a substantially airtight noncombustible partition or partitions.

9. Except as provided in B.11(c)3 the following minimum distances shall be maintained between direct fired vaporizers and nearest important building or group of buildings or line of adjoining property which may be built upon:

10 feet for vaporizers having a capacity of 15 gallons per hour or less vaporizing capacity.

25 feet for vaporizers having a vaporizing capacity of 16 to 100 gallons per hour.

50 feet for vaporizers having a vaporizing capacity exceeding 100 gallons per hour.

10. Direct fired vaporizers shall not raise the product pressure above the design pressure of the vaporizer equipment nor shall they raise the product pressure within the storage container above the pressure shown in the second column of the table in 2.1(a).

11. Vaporizers shall not be provided with fusible plugs.

12. Vaporizers shall not have unprotected drains to sewers or sump pits.

(d) Direct gas-fired tank heaters shall be constructed and installed as follows:

1. Direct gas-fired tank heaters, and tanks to which they are applied, shall only be installed aboveground.

2. Tank heaters shall be permanently marked with the name of the manufacturer, the rated Btu input to the burner, and the maximum vaporizing capacity in gallons per hour.

3. Tank heaters may be an integral part of a fuel storage container directly connected to the container liquid section, or vapor section, or both.

4. Tank heaters shall be provided with a means for manually turning off the gas to the main burner and pilot.

5. Tank heaters shall be equipped with an automatic safety device to shut off the flow of gas to main burners, if pilot light should fail. When flow through pilot exceeds 2,000 Btu per hour,

the pilot also shall be equipped with automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

6. Pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired tank heater shall be separated from the open flame by a substantially airtight noncombustible partition.

7. The following minimum distances shall be maintained between a storage tank heated by a direct fired tank heater and nearest important building or group of buildings or line of adjoining property which may be built upon:

10 feet for storage containers of less than 500 gallons water capacity.

25 feet for storage containers of 500 to 1,200 gallons water capacity.

50 feet for storage containers of over 1,200 gallons water capacity.

8. No direct fired tank heater shall raise the product pressure within the storage container over 75 per cent of the pressure set out in the second column of the table of 2.1(a).

(e) The vaporizer section of vaporizer-burners used for dehydrators or dryers shall be located outside of buildings. They shall be constructed and installed as follows:

1. Vaporizer-burners shall have a minimum design pressure of 250 psig with a factor of safety of five.

2. Manually operated positive shutoff valves shall be located at the containers to shut off all flow to the vaporizer-burners.

3. Minimum distances between storage containers and vaporizer-burners shall be as follows:

Water Capacity Per Container	Minimum Distances
Less than 501 gallons	10 feet
501 to 2,000 gallons	25 feet
Over 2,000 gallons	50 feet

4. The vaporizer section of vaporizer-burners shall be protected by a hydrostatic relief valve. The relief valve shall be located so as not to be subjected to temperatures in excess of 140 F. The start-to-discharge pressure setting shall be such as to protect the components involved, but not less than 250 psig. The discharge shall be directed upward and away from component parts of the equipment and away from operating personnel.

5. Vaporizer-burners shall be provided with means for manually turning off the gas to the main burner and pilot.

6. Vaporizer-burners shall be equipped with automatic safety devices to shut off the flow of gas to the main burner and pilot in the event the pilot is extinguished (see NFPA No. 93).

7. Pressure regulating and control equipment shall be located or protected so that the temperatures surrounding this equipment shall not exceed 140 F except that equipment components may be used at higher temperatures if designed to withstand such temperatures.

8. Pressure regulating and control equipment when located downstream of the vaporizer shall be designed to withstand the maximum discharge temperature of the vapor.

9. The vaporizer section of vaporizer-burners shall not be provided with fusible plugs.

10. Vaporizer coils or jackets shall be made of ferrous metal or high temperature alloys.

11. Equipment utilizing vaporizer-burners shall be equipped with automatic shutoff devices upstream and downstream of the vaporizer section connected so as to operate in the event of excessive temperature, flame failure and, if applicable, insufficient air flow (see Standard for Dehydrators and Dryers for Agricultural Products, NFPA No. 93).

B.12. Filling Densities

(a) The “filling density” is defined as the per cent ratio of the weight of the gas in a container to the weight of water the container will hold at 60 F. All containers shall be filled according to the filling densities shown in Table 3.

(b) The maximum liquid volume in per cent of the total container capacity may be determined for LP Gases at any liquid temperature by using the formula shown in Appendix C.

(See informational graphs, Appendix C — Figures C-1, C-2 and C-3, for certain specific products.)

(c) The maximum liquid volume in per cent of total container capacity shown in Appendix D may be used in lieu of Table 3 to determine the maximum quantity that may be placed in a container.

(d) Except as provided in B.12(e), any container including mobile cargo tanks and portable tank containers regardless of size or construction, shipped under ICC* jurisdiction or constructed in

*See I.1.(e).

Table 3
MAXIMUM PERMITTED FILLING DENSITY.

Specific Gravity at 60 F. (15.6 C.)	Aboveground Containers		Underground Containers All Capacities
	0 to 1200 U.S. Gals. (1000 Imp. gal., 4550 liters) Total Water Cap.	Over 1200 U.S. Gals. (1000 Imp. gal., 4550 liters) Total Water Cap.	
.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

accordance with ICC* Specifications shall be charged according to ICC* requirements.

(e) Portable containers not subject to ICC* jurisdiction (such as, but not limited to, motor fuel containers on industrial and lift trucks, and farm tractors covered in Division IV, or containers re-charged at the installation) may be filled either by weight, or by volume using a fixed length dip tube gaging device.

B.13. Pressures Inside Buildings

(a) Gas for fuel purposes in either the liquid or vapor phase shall not be piped into any building at pressures in excess of 20 psig except as follows:

1. Buildings used exclusively to house equipment for vaporization, pressure reduction, gas mixing, gas manufacturing or distribution.

2. Buildings, or separate fire divisions of buildings, used exclusively to house internal combustion engines or industrial processes.

*See I.1.(e).

3. Buildings, or separate fire divisions of buildings, used exclusively for research and experimental laboratories.

4. Buildings, structures, or equipment under construction or repair.

(b) Portable containers shall not be taken into buildings except as provided in B.6(a).

B.14. Transfer of Liquids

(a) 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.

(b) Containers shall be filled or used only upon authorization of the owner.

(c) Containers manufactured in accordance with specifications of ICC* and authorized by ICC* Regulations as a “single trip” or “nonrefillable container” shall not be refilled or reused in LP-Gas service.

(d) Gas or liquid shall not be vented to the atmosphere to assist in transferring contents of one container to another, except as provided in 4.4(d) and except that this shall not preclude the use of listed pump utilizing LP-Gas in the vapor phase as a source of energy and venting such gas to the atmosphere at a rate not to exceed that from a No. 31 drill size opening and provided that such venting and liquid transfer shall be located not less than 50 feet from the nearest important building.

(e) Filling of fuel containers for industrial trucks or motor vehicles from industrial bulk storage containers shall be performed not less than 10 feet from the nearest important masonry-walled building or not less than 25 feet from the nearest important building of other construction and, in any event, not less than 25 feet from any building opening. For Service Stations, see Division VIII.

(f) Filling of portable containers, containers mounted on skids, fuel containers on farm tractors or similar applications, from storage containers used in domestic or commercial service, shall be performed not less than 50 feet from the nearest important building.

(g) Filling of containers in trailer courts shall be in accordance with the provisions of 6.13.

*See I.1.(e).

(h) Fuel supply containers shall be gaged and charged only in the open air or in buildings especially provided for that purpose.

(i) The maximum vapor pressure of the product at 100 F. which may be transferred into a container shall be in accordance with 2.1, 3.1, and 4.2. (For ICC* containers use ICC* requirements.)

(j) Marketers and users shall exercise precaution 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.

(k) Pumps or compressors shall be designed for use with LP-Gas. When compressors are used they shall normally take suction from the vapor space of the container being filled and discharge to the vapor space of the container being emptied.

(l) Pumping systems, when equipped with a positive displacement pump, shall include a recirculating device which shall limit the differential pressure on the pump under normal operating conditions to the maximum differential pressure rating of the pump. The discharge of the pumping system shall be protected so that pressure does not exceed 350 psig. If a recirculation system discharges into the supply tank and contains a manual shutoff valve, an adequate secondary safety recirculation system shall be incorporated which shall have no means of rendering it inoperative. Manual shutoff valves in recirculation systems shall be kept open except during an emergency or when repairs are being made to the system.

(m) When hose is to be used for transferring liquid from one container to another, wet hose is recommended. Such hose shall be equipped with suitable shutoff valves at discharge end. Provision shall be made to prevent excessive hydrostatic pressure in the hose.

(n) When necessary, unloading piping or hoses shall be provided with suitable bleeder valves for relieving pressure before disconnection.

(o) Agricultural air moving equipment, including crop dryers, shall be shut down when supply containers are being filled unless the air intakes and sources of ignition on the equipment are located 50 feet or more from the container.

*See I.1.(e).

(p) Agricultural equipment employing open flames or equipment with integral containers, such as flame cultivators, weed burners, and, in addition, tractors, shall be shut down during refueling (see 4.1(e)).

B.15. Tank Car or Transport Truck Unloading Points and Operations

(a) The track of tank car siding shall be relatively level.

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

(c) While cars are on sidetrack for unloading, the wheels at both ends shall be blocked on the rails. For transport truck loading or unloading see 3.15.

(d) A man shall be in attendance at all times while the tank car, cars or trucks are being unloaded.

(e) The pipe line to which the unloading hoses are connected shall be equipped with a backflow check valve to prevent discharge of the LP-Gas from the receiving container and line in case of line hose and fittings rupture.

(f) The tank car or transport truck unloading point should be located with due consideration to the following:

1. Proximity to railroads and highway traffic.
2. The distance of such unloading point from adjacent property.
3. With respect to buildings on installer's property.
4. Nature of occupancy.
5. Topography.
6. Type of construction of buildings.
7. Number of tank cars or transport trucks that may be safely unloaded at one time.
8. Frequency of unloading.

(g) Where practical, the distance of the unloading point should conform to the distances in B.6(b), except that lesser distances may be used, keeping in mind the above items and upon approval of the authority having jurisdiction.

B.16. Instructions

(a) Personnel performing installation, removal, operation and maintenance work shall be properly trained in such function.

*See I.1.(e).

B.17. Electrical Equipment and Other Sources of Ignition

(a) Electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with the National Electrical Code, NFPA No. 70 (USA Standard C1) for ordinary locations except that fixed electrical equipment in classified areas shall comply with B.18.

(b) Open flames or other sources of ignition shall not be permitted in vaporizer rooms (except those housing direct-fired vaporizers), pump houses, container charging rooms or other similar locations. Direct-fired vaporizers shall not be permitted in pump houses or container charging rooms.

(c) Liquefied petroleum gas storage containers do not require lightning protection (see NFPA No. 78, Lightning Protection Code).

(d) 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 NFPA No. 77, Recommended Practice on Static Electricity).

(e) Open flames (except as provided for in B.11), cutting or welding, portable electric tools and extension lights capable of igniting LP-Gas, shall not be permitted within classified areas specified in Table 4 unless the LP-Gas facilities have been freed of all liquid and vapor, or special precautions observed under carefully controlled conditions.

B.18. Fixed Electrical Equipment in Classified Areas.

(a) Fixed electrical equipment and wiring installed within classified areas specified in Table 4 shall comply with Table 4 and shall be installed in accordance with the National Electrical Code, NFPA No. 70 (USA Standard C1). This provision does not apply to fixed electrical equipment at residential or commercial installations of LP-Gas systems or to systems covered by Divisions IV, VI or VII.

(b) Electrical equipment installed on LP-Gas cargo vehicles shall comply with Division III.

B.19. Liquid Level Gaging Device

(a) Each container manufactured after December 31, 1965 and filled on a volumetric basis shall be equipped with a fixed liquid level gage to indicate the maximum permitted filling level as provided in B.19(e). When a variable liquid level gage is also provided, the fixed liquid level gage will also serve as a means for checking

Table 4

Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²

<i>Part</i>	<i>Location</i>	<i>Extent of Classified Area¹</i>	<i>Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²</i>
A	Storage Containers Other Than ICC* Cylinders.	Within 15 feet in all directions from connections, except connections otherwise covered in Table 4.	Division 2
B	Tank Vehicle and Tank Car Loading and Unloading. ³	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1
		Beyond 5 feet but within 15 feet 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. (See Figure 1)	Division 2
C	Gage Vent Openings Other Than Those On ICC* Cylinders.	Within 5 feet in all directions from point of discharge.	Division 1
		Beyond 5 feet but within 15 feet in all directions from point of discharge.	Division 2
D	Relief Valve Discharge Other Than Those on ICC* Cylinders.	Within direct path of discharge.	Division 1 Note: Fixed electrical equipment should preferably not be installed.
		Within 5 feet in all directions from point of discharge.	Division 1
		Beyond 5 feet but within 15 feet in all directions from point of discharge except within the direct path of discharge.	Division 2

*See I.1.(e).

- ¹ The classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition.
- ² See Article 500 — "Hazardous Locations" in NFPA No. 70 (USA Standard C1) for definitions of Classes, Groups, and Divisions.
- ³ When classifying extent of hazardous area, consideration shall be given to possible variations in the spotting of tank cars and tank vehicles at the unloading points and the effect these variations of actual spotting point may have on the point of connection.

(Continued)

<i>Part</i>	<i>Location</i>	<i>Extent of Classified Area¹</i>	<i>Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²</i>	
E	Pumps, compressors, gas-air mixers and vaporizers other than direct fired.			
		Indoors without ventilation.	Entire room and any adjacent room not separated by a gastight partition.	Division 1
			Within 15 feet of the exterior side of any exterior wall or roof that is not vaportight or within 15 feet of any exterior opening.	Division 2
		Indoors with adequate ventilation. ⁴	Entire room and any adjacent room not separated by a gastight partition.	Division 2
		Outdoors in open air at or abovegrade.	Within 15 feet in all directions from this equipment and within the cylindrical volume between the horizontal equator of the sphere and grade. (See Figure 1)	Division 2
F	Service Station Dispensing Units.		Division 1	
			Up to 18 inches abovegrade within 20 ft. horizontally from any edge of enclosure. Note: For pits within this area, see Part F of this table.	Division 2

¹ The classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition.

² See Article 500 — "Hazardous Locations" in NFPA No. 70 (USA Standard C1) for definitions of Classes, Groups, and Divisions.

⁴ Ventilation, either natural or mechanical, is considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit under normal operating conditions.

(Continued)

BASIC RULES

Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²

Part	Location	Extent of Classified Area¹	Division	
G	Pits or trenches containing or located beneath LP-Gas valves, pumps, compressors, regulators, and similar equipment.	Entire pit or trench	Division 1	
		Without mechanical ventilation.		
		Entire room and any adjacent room not separated by a gastight partition.	Division 2	
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2	
		With adequate mechanical ventilation.	Entire pit or trench.	Division 2
			Entire room and any adjacent room not separated by a gastight partition.	Division 2
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2	
H	Special Buildings or rooms for storage of portable containers.	Entire room.	Division 2	
I	Pipelines and connections containing operational bleeds, drips, vents or drains.	Within 5 ft. in all directions from point of discharge.	Division 1	
		Beyond 5 ft. from point of discharge, same as Part E of this table.		

¹ The classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition.

² See Article 500 — "Hazardous Locations" in NFPA No. 70 (USA Standard C1) for definitions of Classes, Groups, and Divisions.

Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²

<i>Part</i>	<i>Location</i>	<i>Extent of Classified Area¹</i>	<i>Equipment Shall Be Suitable for National Electrical Code, Class 1, Group D²</i>
J	Container Filling:		
	Indoors without ventilation	Entire room	Division 1
	Indoors with adequate ventilation ⁴	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1
		Beyond 5 feet and entire room.	Division 2
	Outdoors in open air	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1
		Beyond 5 feet but within 15 feet 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. (See Figure 1)	Division 2

- ¹ The classified area shall not extend beyond an unpierced wall, roof, or solid vaportight partition.
- ² See Article 500 — "Hazardous Locations" in NFPA No. 70 (USA Standard C1) for definitions of Classes, Groups, and Divisions.
- ⁴ Ventilation, either natural or mechanical, is considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit under normal operating conditions.

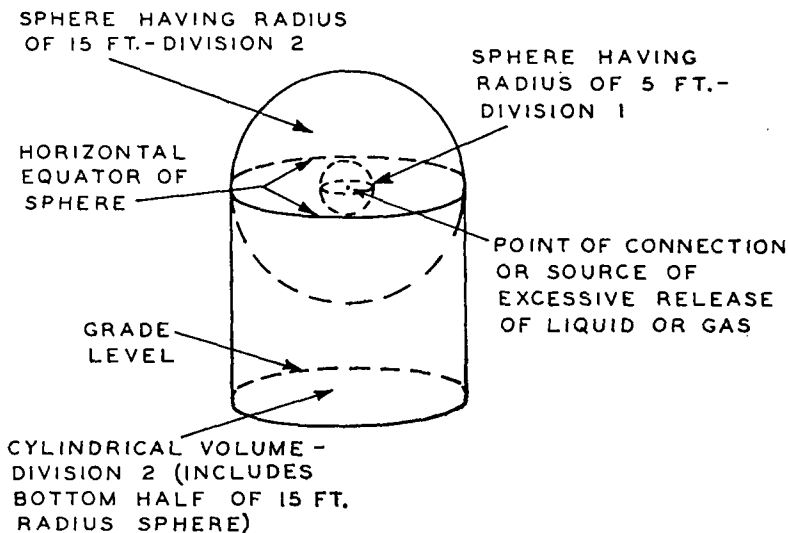


Figure 1
(See Table 4)

Continued from page 58-30

the variable gage. These gages shall be used in charging containers as required in B.12.

(b) All variable gaging 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 charged is readily determinable. The markings indicating the various liquid levels from empty to full shall be on the system nameplate or gaging device or part may be on the system nameplate and part on the gaging device. Dials of magnetic or rotary gages shall show whether they are for cylindrical or spherical containers and whether for aboveground or underground service. The dials of gages intended for use only on aboveground containers of over 1,200 gallons water capacity shall be so marked (see B.12).

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

(d) Gaging devices shall have a design working pressure of at least 250 psig.

(e) Length of tube or position of fixed liquid level gage 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 underground containers. Refer to Appendix E for calculating filling point for which fixed liquid level gage shall be designed.

(f) Fixed liquid level gages used on containers other than ICC* shall be stamped on the exterior of the gage with the letters "DT" followed by the vertical distance (expressed in inches and carried out to one decimal place) from the top of container to the end of the dip tube or to the centerline of the gage when it is located at the maximum permitted filling level. For ICC* containers the stamping shall be placed both on the exterior of the gage and on the container. On aboveground or cargo containers where the gages are positioned at specific levels, the marking may be specified in per cent of total tank contents and the marking shall be stamped on the container.

(g) Gage glasses of the columnar type shall be restricted to charging plants where the fuel is withdrawn in the liquid phase only. They shall be equipped with valves having metallic handwheels, with excess flow valves, and with extra heavy glass adequately protected with a metal housing applied by the gage manufacturer. They shall be shielded against the direct rays of the sun. Gage glasses of the columnar type are prohibited on tank trucks, and on motor fuel tanks, and on containers used in domestic, commercial and industrial installations.

(h) Gaging devices of the float, or equivalent type which do not require flow for their operation and having connections extending to a point outside the container do not have to be equipped with excess flow valves provided the piping and fittings are adequately designed to withstand the container pressure and are properly protected against physical damage and breakage.

B.20. Requirements for Appliances

(a) Except as provided in B.20(b) and (c), LP-Gas appliances shall be approved.

(b) In cases where no applicable standard has been developed for a given class of appliance or accessory, approval of the authority having jurisdiction may be required before the appliance or accessory is installed.

*See I.1.(e).

(c) Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas and is in good condition may be used with LP-Gas only after it is properly converted, adapted and tested for performance with LP-Gas before the appliance is placed in use.

(d) Unattended heaters used inside buildings for the purpose of animal or poultry production or care shall be equipped with an approved automatic device designed to shut off the flow of gas to the main burners, and pilot if used, in the event of flame extinguishment. For domestic appliances in buildings, see NFPA No. 54 (USA Standard Z21.30), Standard for the Installation of Gas Appliances and Gas Piping. For heaters used for drying of agricultural products, see Standard for Dehydrators and Dryers for Agricultural Products, NFPA No. 93.

DIVISION I. CYLINDER SYSTEMS

(Sometimes called Bottled Gas)

Division I applies specifically to systems utilizing containers constructed in accordance with the Interstate Commerce Commission Specifications.* All Basic Rules apply to this Division unless otherwise noted in the Basic Rules. (Refer to Divisions IV, VI and VII for additional provisions.)

1.1. Marking of Containers

(a) Containers shall be marked in accordance with the Interstate Commerce Commission* regulations. Additional markings not in conflict with the Interstate Commerce Commission* regulations may be used.

(b) Except as provided in 1.1(c) each container shall be marked with its water capacity in pounds or other identified unit of weight.

(c) If a container is filled and maintained only by the owner or his representative and if the water capacity of each container is identified by a code, compliance with paragraph 1.1(b) is not required.

(d) Each container shall be marked with its tare weight in pounds or other identified unit of weight including all permanently attached fittings but not the cap.

1.2. Description of a Division I System

(a) A Division I system shall include the container base or bracket, containers, container valves, connectors, manifold valve assembly, regulators and relief valves.

1.3. Containers and Regulating Equipment Installed Outside of Buildings or Structures

(a) Containers shall not be buried below ground. However, this shall not prohibit the installation in a compartment or recess below grade level, such as a niche in a slope or terrace wall which is used for no other purpose, providing that the container and regulating equipment are not in contact with the ground and the compartment or recess is drained and ventilated horizontally to the outside air from its lowest level, with the outlet at least 3 feet away from any building opening which is below the level of such outlet.

*See I.1.(e).

Except as provided in B.10 (k), the discharge from safety relief devices shall be located not less than 3 feet horizontally away from any building opening which is below the level of such discharge and shall not terminate beneath any building unless such space is well ventilated to the outside and is not enclosed on more than two sides.

(b) Containers shall be set upon firm foundation or otherwise firmly secured; the possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.

1.4. Containers and Equipment Used Inside of Buildings or Structures

(a) **GENERAL.** When operational requirements make portable use of containers necessary and their location outside of buildings or structures is impracticable, containers and equipment are permitted to be used inside of buildings or structures in accordance with 1.4(a)1 through 12, and, in addition, such other provisions of 1.4 as are applicable to the particular use or occupancy.

1. Containers in use shall mean *connected* for use.

2. Systems utilizing containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall be equipped with excess flow valves. Such excess flow valves shall be either integral with the container valves or in the connections to the container valve outlets. In either case, an excess flow valve shall be installed in such a manner that any undue strain beyond the excess flow valve will not cause breakage between the container and the excess flow valve. The installation of excess flow valves shall take into account the type of valve protection provided [see 1.4 (a)4].

3. Regulators, if used, shall be either directly connected to the container valves or to manifolds connected to the container valves. The regulator shall be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 250 psig service pressure.

4. Valves on containers having a water capacity greater than 50 pounds (nominal 20 pounds LP-Gas capacity) shall be protected while in use [also see 1.5(c)].

NOTE: The conventional closed top screw-on caps, normally used to protect cylinder valves in storage, transit, and while being placed into position, do not protect the container valves while in use.

5. Containers shall be marked in accordance with B.5(c) and 1.1.

6. Pipe or tubing shall conform to B.8 except that aluminum pipe or tubing shall not be used (see 1.4(a)7 for hose).

7. Hose shall be designed for a working pressure of at least 250 psig. Hose and hose connections shall have their correctness as to design, construction and performance determined by: listing by Underwriters' Laboratories, Inc., listing by a nationally recognized testing agency, or approval by the authority having jurisdiction. The hose length may exceed the length specified in B.9(g)2, but shall be as short as practicable. Hose shall be long enough to permit compliance with spacing provisions of 1.4 without kinking or straining or causing hose to be so close to a burner as to be damaged by heat.

8. Portable heaters, including salamanders, shall be approved.

9. Portable heaters, including salamanders, shall be equipped with an approved automatic device designed to shut off the flow of gas to the main burner, and pilot if used, in the event of flame extinguishment. Such heaters having inputs above 50,000 btu per hour shall be equipped with either (1) a pilot which must be lighted and proved before the main burner fuel can be turned on; or (2) an electric ignition system.

The provisions of 1.4(a)9 do not apply to tar kettle burners, torches, melting pots, nor do they apply to portable heaters under 7,500 btu per hour input when used with containers having a maximum water capacity of 2½ pounds.

10. Containers, regulating equipment, manifolds, pipe, tubing and hose shall be located so as to minimize exposure to abnormally high temperatures (such as may result from exposure to convection or radiation from heating equipment), physical damage, or tampering by unauthorized persons.

11. Heat producing equipment shall be located and used so as to minimize the possibility of ignition of combustibles.

12. Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) connected for use, shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position.

13. Containers, including the valve protective devices, shall be installed so as to minimize the probability of impingement of discharge of safety relief devices upon containers.

(b) **SMALL CONTAINERS.** Containers having a maximum water capacity of 2½ pounds (nominal 1 pound LP-Gas capacity) are permitted to be used inside of buildings as part of self-contained hand torch assemblies or similar appliances.

(c) **PUBLIC EXHIBITIONS OR DEMONSTRATIONS.** Containers having a maximum water capacity of 12 pounds (nominal 5 pounds LP-Gas capacity) are permitted to be used temporarily inside of buildings for public exhibition or demonstration purposes, including use for classroom demonstrations.

(d) **BUILDINGS FREQUENTED BY THE PUBLIC:**

1. When buildings frequented by the public are open to the public, containers are permitted to be used for repair or minor renovation, as follows:

(a) The maximum water capacity of individual containers shall be 50 pounds (nominal 20 pounds LP-Gas capacity).

(b) The number of LP-Gas containers shall not exceed the number of workmen assigned to using the LP-Gas.

(c) Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall not be left unattended in such buildings.

2. When buildings frequented by the public are not open to the public, containers are permitted to be used for repair or minor renovations, as follows:

(a) The provisions of 1.4(e) shall apply except that containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall not be left unattended in such buildings.

(e) **BUILDINGS OR STRUCTURES UNDER CONSTRUCTION OR UNDERGOING MAJOR RENOVATION:** Containers are permitted to be used in buildings or structures under construction or undergoing major renovation when such buildings or structures are not occupied by the public, as follows:

1. The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).

2. For temporary heating such as curing concrete, drying plaster and similar applications, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the container. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet.

3. If two or more heater-container units, of either the integral or nonintegral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be sepa-

rated from the container or containers of any other unit by at least 20 feet.

4. When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers manifolded together for connection to a heater or heaters shall not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity). Such manifolds shall be separated by at least 20 feet.

5. On floors on which heaters are not connected for use, containers are permitted to be manifolded together for connection to a heater or heaters on another floor, provided (a) the total water capacity of containers connected to any one manifold is not greater than 2,450 pounds (nominal 1,000 pounds LP-Gas capacity) and (b) where more than one manifold having a total water capacity greater than 735 pounds (nominal 300 pounds LP-Gas capacity) are located in the same unpartitioned area, they shall be separated by at least 50 feet.

6. When compliance with the provisions of 1.4(e)4 and 5 is impractical, they may be altered by the authority having jurisdiction.

7. Storage of containers awaiting use shall be in accordance with Division V.

(f) **INDUSTRIAL OCCUPANCIES FOR PROCESSING, RESEARCH OR EXPERIMENTAL PURPOSES:** Containers are permitted to be used in industrial occupancies for processing, research or experimental purposes as follows:

1. The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).

2. Containers connected to a manifold shall have a total water capacity not greater than 735 pounds (nominal 300 pounds LP-Gas capacity) and not more than one such manifold may be located in the same room unless separated at least 20 feet from a similar unit.

3. The amount of LP-Gas in containers for research and experimental use shall be limited to the smallest practical quantity.

(g) **INDUSTRIAL OCCUPANCIES UTILIZING PORTABLE EQUIPMENT FOR SPACE HEATING:** Containers are permitted to be used in industrial occupancies with essentially noncombustible contents where portable equipment for space heating is essential and where a permanent heating installation is not practical, as follows:

1. Containers and heaters shall comply with and be used in accordance with 1.4(e).

(h) **EMERGENCY HEATING:** Containers are permitted to be used in buildings for temporary emergency heating purposes, if neces-

sary to prevent damage to the buildings or contents, when the permanent heating system is temporarily out of service, as follows:

1. Containers and heaters shall comply with and be used in accordance with 1.4(e).
2. The temporary heating equipment shall not be left unattended.

(i) **EDUCATIONAL AND INSTITUTIONAL OCCUPANCIES FOR NON-CLASSROOM RESEARCH OR EXPERIMENTAL PURPOSES:** Containers are permitted to be used in educational and institutional laboratory occupancies for research or experimental purposes, but not in classrooms, as follows:

1. The maximum water capacity of individual containers shall be 50 pounds (nominal 20 pounds LP-Gas capacity) when used in educational occupancies. The maximum water capacity of individual containers shall be 12 pounds (nominal 5 pounds LP-Gas capacity) when used in institutional occupancies.
2. If more than one such container is located in the same room, the containers shall be separated by at least 20 feet.
3. Containers not connected for use shall be stored in accordance with Division V, except that they shall not be stored in a laboratory room.

(j) **TEMPORARY USE FOR TRAINING PURPOSES:** Containers are permitted to be used temporarily in buildings for training purposes related in installation and use of LP-Gas systems, as follows:

1. The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity), but the maximum quantity of LP-Gas that may be placed in each container shall be 20 pounds.
2. If more than one such container is located in the same room, the containers shall be separated by at least 20 feet.
3. The training location shall be acceptable to the authority having jurisdiction.
4. Containers shall be removed from the building when the training class has terminated.

1.5. Container Valves and Accessories

(a) Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system.

NOTE: This provision is not to be construed as requiring an automatic change-over device.

(b) Regulators and low pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls or otherwise rigidly secured, and shall be so installed that the elements will not affect their operation.

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

(c) Valves and connections to the containers shall be protected while in transit, in storage, and while being moved into final utilization, as follows:

1. By setting into recess of container to prevent possibility of their being struck if container is dropped upon a flat surface, or
2. By ventilated cap or collar, fastened to container capable of withstanding blow from any direction equivalent to that of a 30-pound weight dropped 4 feet. Construction must be such that a blow will not be transmitted to valve or other connection.

(d) When containers are not connected to the system, the outlet valves shall be kept tightly closed or plugged, even though containers are considered empty.

(e) Containers having a water capacity in excess of 50 pounds (approximately 21 pounds LP-Gas capacity), recharged at the installation, shall be provided with excess flow or backflow check valves to prevent the discharge of container contents in case of failure of the filling or equalizing connection [see B.7(h)].

1.6. Safety Devices

(a) Containers shall be provided with safety devices as required by the Interstate Commerce Commission* regulations.

(b) A final stage regulator of an LP-Gas system (excluding any appliance regulator) shall be equipped on the low pressure side with a relief valve which is set to start to discharge within the limits specified in Table 5.

Table 5
Relief Valve Start-to-Discharge Pressure Setting
(Per Cent of Regulator Delivery Pressure)

<i>Regulator Delivery Pressure</i>	<i>Minimum</i>	<i>Maximum</i>
1 psig or less	200 %	300 %
Above 1 psig but not over 3 psig	140 %	200 %
Above 3 psig	125 %	200 %

(c) When a regulator or pressure relief valve is used inside a building for other than purposes specified in B.6(a)1 through 7, the relief valve and the space above the regulator and relief valve diaphragms shall be vented to the outside air with the discharge

outlet located not less than three feet horizontally away from any building opening which is below such discharge. (These provisions do not apply to individual appliance regulators when protection is otherwise provided (see NFPA No. 54), nor to 1.4 and B.10(k)). In buildings devoted exclusively to gas distribution purposes, the space above the diaphragm need not be vented to the outside.

1.7. Reinstallation of Containers

(a) Containers shall not be reinstalled unless they are requalified in accordance with currently effective regulations of the Interstate Commerce Commission.*

1.8. Permissible Product

(a) A product shall not be placed in a container marked with a service pressure less than four-fifths of the maximum vapor pressure of product at 130 F.

*See I.1.(e).

DIVISION II. SYSTEMS UTILIZING CONTAINERS OTHER THAN ICC***

Division II applies specifically to systems utilizing storage containers other than those constructed in accordance with Interstate Commerce Commission*** specifications. All basic rules apply to this Division unless otherwise noted in the Basic Rules. (Refer to Divisions IV, VI, VII and VIII for additional provisions.)

2.1. Design Pressure and Classification of Storage Containers

(a) Storage containers shall be designed and classified in accordance with Table 6.

Table 6

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gage at 100 F. (37.8 C.)	Minimum Design Pressure of Container lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201), 1950, 1952, 1956, 1959, 1962, and 1965 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 U201), (2) 1950, 1952, 1956, 1959, 1962, and 1965 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, 1961.

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.

***See I.1.(e).

2.2. Container Valves and Accessories, Filler Pipes and Discharge Pipes

(a) The filling pipe inlet terminal shall not be located inside a building. For containers with a water capacity of 125 gallons or more, such terminals shall be located not less than 10 feet from any building, see B.6(b), and preferably not less than 5 feet from any driveway, and shall be located in a protective housing built for the purpose.

(b) The filling connection [see B.7(h)] shall be fitted with one of the following:

1. Combination back-pressure check valve and excess flow valve,
2. One double or 2 single back-pressure check valves,
3. A positive shutoff valve, in conjunction with either:
 - (a) An internal back pressure valve, or
 - (b) An internal excess flow valve.

(c) All openings in a container shall be equipped with approved automatic excess flow valves except in the following: filling connections as provided in 2.2(b); safety relief connections, liquid level gaging devices as provided in B.7(d), B.19(c) and B.19(h); pressure gage connections as provided in B.7(e), as provided in 2.2(d) and (f) and (g).

(d) An excess flow valve is not required in the withdrawal service line providing the following are complied with:

1. Such systems' total water capacity does not exceed 2,000 U. S. gallons.
2. The discharge from the service outlet is controlled by a suitable manually operated shutoff valve:
 - (a) threaded directly into the service outlet of the container; or
 - (b) is an integral part of a substantial fitting threaded into or on the service outlet of the container; or
 - (c) threaded directly into a substantial fitting threaded into or on the service outlet of the container.
3. The shutoff valve is equipped with an attached handwheel or the equivalent.
4. The controlling orifice between the contents of the container and the outlet of the shutoff valve does not exceed $\frac{5}{16}$ inch in diameter for vapor withdrawal systems and $\frac{1}{8}$ inch in diameter for liquid withdrawal systems.
5. An approved pressure-reducing regulator is directly attached to the outlet of the shutoff valve and is rigidly supported, or that an

approved pressure-reducing regulator is attached to the outlet of the shutoff valve by means of a suitable flexible connection, provided the regulator is adequately supported and properly protected on or at the tank (see 2.8).

(e) All inlet and outlet connections except safety relief valves, liquid level gaging devices and pressure gages on containers of 2,000 gallons water capacity, or more, and on any container used to supply fuel directly to an internal combustion engine, shall be labeled to designate whether they communicate with vapor or liquid space. Labels may be on valves.

(f) In lieu of an excess flow valve; openings may be fitted with a quick-closing internal valve which except during operating periods shall remain closed. The internal mechanism for such valves may be provided with a secondary control which shall be equipped with a fusible plug (not over 220 F melting point) which will cause the internal valve to close automatically in case of fire.

(g) Not more than two plugged openings shall be permitted on a container of 2,000 gallons or less water capacity.

(h) Containers of 125 gallons water capacity or more manufactured after JULY 1, 1961, shall be provided with an approved device for liquid evacuation, the size of which shall be $\frac{3}{4}$ inch National Pipe Thread minimum. A plugged opening will not satisfy this requirement.

2.3. Safety Devices

(a) GENERAL. All safety devices shall comply with the following:

1. All container safety relief devices shall be located on the containers and shall have direct communication with the vapor space of the container.

2. In industrial and gas manufacturing plants, discharge pipe from safety relief valves on pipe lines within a building shall discharge vertically upward and shall be piped to a point outside a building.

3. Safety relief device discharge terminals shall be so located as to provide protection against physical damage and such discharge pipes shall be fitted with loose raincaps. Return bends and restrictive pipe fittings shall not be permitted.

4. If desired, discharge lines from two or more safety relief devices located on the same unit, or similar lines from two or more different units, may be run into a common discharge header, provided that the cross-sectional area of such header be at least equal to the sum of the cross-sectional area of the individual discharge lines, and that the settings of safety relief valves are the same.

5. Each storage container of over 2,000 gallons water capacity shall be provided with a suitable pressure gage.

6. A final stage regulator of an LP-Gas system (excluding any appliance regulator) shall be equipped on the low pressure side with a relief valve which is set to start to discharge within the limits specified in Table 5 in Division I.

7. When a regulator or pressure relief valve is installed inside a building, the relief valve and the space above the regulator and relief valve diaphragms shall be vented to the outside air with the discharge outlet located not less than three feet horizontally away from any opening into the building which is below such discharge. (These provisions do not apply to individual appliance regulators when protection is otherwise provided. In buildings devoted exclusively to gas distribution purposes, the space above the diaphragm need not be vented to the outside.)

(b) ABOVEGROUND CONTAINERS: Safety devices for aboveground containers shall be provided as follows:

1. Containers of 1,200 gallons water capacity or less which may contain liquid fuel when installed aboveground shall have the rate of discharge required by Appendix A provided by spring loaded relief valve or valves. In addition to the required spring loaded relief valve(s), suitable fuse plug(s) may be used provided the total discharge area of the fuse plug(s) for each container does not exceed 0.25 square inch.

2. The fusible metal of the fuse plugs shall have a yield temperature of 208 F minimum and 220 F maximum. Relief valves and fuse plugs shall have direct communication with the vapor space of the container.

3. On a container having a water capacity greater than 125 gallons, but not over 2,000 gallons, the discharge from the safety relief valves shall be vented away from the container vertically upwards and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container; loose fitting rain caps shall be used. Suitable provision shall be made for draining condensate which may accumulate in the relief valve or its discharge pipe [see B.10(i)].

4. On containers of 125 gallons water capacity or less, the discharge from safety relief devices shall be located not less than 5 feet horizontally away from any opening into the building below the level of such discharge.

5. On a container having a water capacity greater than 2,000 gallons, the discharge from the safety relief valves shall be vented away from the container vertically upwards to a point at least 7 feet above the container, and unobstructed to the open air in such a man-

ner as to prevent any impingement of escaping gas upon the container; loose fitting rain caps shall be used. Suitable provision shall be made so that any liquid or condensate that may accumulate inside of the safety relief valve or its discharge pipe will not render the valve inoperative. If a drain is used, a means shall be provided to protect the container, adjacent containers, piping or equipment against impingement of flame resulting from ignition of product escaping from the drain [see B.10(i)].

(c) **UNDERGROUND CONTAINERS:** On all containers which are installed underground and which contain no liquid fuel until buried and covered, the rate of discharge of spring loaded relief valve installed thereon may be reduced to a minimum of 30 per cent of the specified rate of discharge in Appendix A. Containers so protected shall not be uncovered after installation until the liquid fuel has been removed therefrom. Containers which may contain liquid fuel before being installed underground and before being completely covered with earth are to be considered aboveground containers when determining the rate of discharge requirement of the relief valves.

(d) On underground containers of more than 2,000 gallons water capacity, the discharge from safety relief devices shall be piped vertically and directly upward to a point at least 7 feet above the ground.

1. Where there is a probability of the manhole or housing becoming flooded, the discharge from regulator vent lines shall be above the highest probable water level. All manholes or housings shall be provided with ventilated louvers of their equivalent, the area of such openings equalling or exceeding the combined discharge areas of the safety relief valves and other vent lines which discharge their content into the manhole housing.

(e) **VAPORIZERS:** Safety devices for vaporizers shall be provided as follows:

1. Vaporizers of less than one quart total capacity, heated by the ground or the surrounding air, need not be equipped with safety relief valves provided that adequate tests certified by any of the authorities listed in B.2, demonstrate that the assembly is safe without safety relief valves.

2. No vaporizer shall be equipped with fusible plugs.

3. In industrial and gas manufacturing plants, safety relief valves on vaporizers within a building shall be piped to a point outside the building and be discharged upward.

2.4. Reinstallation of Containers

Containers may be reinstalled if they do not show any evidence of harmful external corrosion or other damage. Where containers are reinstalled underground, the corrosion resistant coating shall be put in good condition; see 2.6(f). Where containers are reinstalled aboveground, the requirements for safety devices and gaging devices shall comply with 2.3 and B.19 respectively for aboveground containers.

2.5. Capacity of Containers

A storage container shall not exceed 90,000 gallons water capacity.

2.6. Installation of Storage Containers

(a) Containers installed aboveground, except as provided in 2.6(g), shall be provided with substantial masonry or noncombustible structural supports on firm masonry foundation.

(b) Aboveground containers shall be supported as follows:

1. Horizontal containers shall be mounted on saddles in such a manner as to permit expansion and contraction. Structural metal supports may be employed when they are protected against fire in an approved manner. Suitable means of preventing corrosion shall be provided on that portion of the container in contact with the foundations or saddles.

2. Containers of 2,000 gallons water capacity or less may be installed with nonfireproofed ferrous metal supports if mounted on concrete pads or footings, and if the distance from the outside bottom of the container shell to the concrete pad, footing or the ground does not exceed 24 inches.

(c) Any container may be installed with nonfireproofed ferrous metal supports if mounted on concrete pads or footings, and if the distance from the outside bottom of the container to the ground does not exceed 5 feet, provided the container is in an isolated location and such installation is approved by the authority having jurisdiction.

(d) Containers may be partially buried providing the following requirements are met:

1. The portion of the container below the surface and for a vertical distance not less than 3 inches above the surface of the ground is protected to resist corrosion, and the container is protected against settling and corrosion as required for fully buried containers [see 2.6(f)].

2. Spacing requirements shall be as specified for underground tanks in B.6(b).

3. Relief valve capacity shall be as required for aboveground containers.

4. Container is located so as not to be subject to vehicular damage, or is adequately protected against such damage.

5. Filling densities shall be as required for aboveground containers.

(e) Containers buried underground shall be placed so that the top of the container is not less than 6 inches below grade. Where an underground container might be subject to abrasive action or physical damage due to vehicular traffic or other causes, then it shall be:

1. Placed not less than 2 feet below grade, or
2. Otherwise protected against such physical damage.

It will not be necessary to cover the portion of the container to which manhole and other connections are affixed; however, where necessary, protection shall be provided against vehicular damage. When necessary to prevent floating, containers shall be securely anchored or weighted.

(f) UNDERGROUND CONTAINERS.

1. Containers shall be given a protective coating before being placed underground. This coating shall be equivalent to hot dip galvanizing or to two coatings of red lead followed by a heavy coating of coal tar or asphalt. In lowering the container into place, care shall be exercised to prevent damage to the coating. Any damage to the coating shall be repaired before backfilling.

2. Containers shall be set on a firm foundation (firm earth may be used) and surrounded with earth or sand firmly tamped in place. Backfill should be free of rocks or other abrasive materials.

(g) Containers with foundations attached (portable or semi-portable containers with suitable steel "runners" or "skids" and popularly known in the industry as "skid tanks") shall be designed, installed and used in accordance with these rules subject to the following provisions: (See also 3.19.)

1. If they are to be used at a given general location for a temporary period not to exceed 6 months they need not have fire-resisting foundations or saddles but shall have adequate ferrous metal supports.

2. They shall not be located with the outside bottom of the container shell more than 5 feet above the surface of the ground unless fire-resisting supports are provided.

3. The bottom of the skids shall not be less than 2 inches or more than 12 inches below the outside bottom of the container shell.

4. Flanges, nozzles, valves, fittings and the like, having communication with the interior of the container shall be protected against physical damage.

NOTE: It is recommended that such containers should have outlets only in the heads.

5. When not permanently located on fire-resisting foundations, piping connections shall be sufficiently flexible to minimize possibility of breakage or leakage of connections if container settles, moves, or is otherwise displaced.

6. Skids, or lugs for attachment of skids, shall be secured to container in accordance with the code or rules under which the container is designed and built (with a minimum factor of safety of four) to withstand loading in any direction equal to four times the weight of the container and attachments when filled to the maximum permissible loaded weight.

(h) Field welding where necessary shall be made only on saddle plates or brackets which were applied by manufacturer of tank.

(i) For aboveground containers secure anchorage or adequate pier height shall be provided against possible container flotation wherever sufficiently high flood water might occur.

(j) When permanently installed containers are interconnected, provision shall be made to compensate for expansion, contraction, vibration and settling of containers and interconnecting piping. Where flexible connections are used, they shall be of an approved type and shall be designed for a bursting pressure of not less than five times the vapor pressure of the product at 100 F. The use of nonmetallic hose is prohibited for permanently interconnecting such containers.

(k) Container assemblies listed for interchangeable installation aboveground or underground shall conform to the requirements for aboveground installations with respect to safety relief capacity and filling density. For installation aboveground all other requirements for aboveground installations shall apply. For installation underground all other requirements for underground installations shall apply.

2.7. Dikes and Embankments

(a) Because of the pronounced volatility of liquefied petroleum gases, dikes are not normally necessary, hence their general require-

ment is not justified as in the case of gasoline or similar flammable liquids. It should be borne in mind that the heavy construction of the storage containers makes failure unlikely.

NOTE: When in the opinion of the authority having jurisdiction, due to local conditions, the contents of aboveground containers are liable in case of container failure to endanger adjacent property, dikes may be specified of such capacity as may be considered necessary to meet the needs of the situation under consideration by the aforesaid authority.

2.8. Protection of Container Accessories

(a) Valves, regulating, gaging and other container accessory equipment shall be protected against tampering and physical damage. Such accessories shall also be so protected during the transit of containers intended for installation underground.

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

(b) On underground or combination aboveground-underground containers, the service valve handwheel, the terminal for connecting the hose, and the opening through which there can be a flow from safety relief valves shall be at least 4 inches above the container and this opening shall be located in the dome or housing. Underground systems shall be so installed that all the above openings, including the regulator vent, are located above the normal maximum water table.

(c) All connections to underground containers shall be located within a substantial dome, housing or manhole and with access thereto protected by a substantial cover.

2.9. Drips for Condensed Gas

Where vaporized gas on low-pressure side of system may condense to a liquid at normal operating temperatures and pressures, suitable means shall be provided for revaporization of the condensate.

2.10. Damage from Vehicles

When damage to LP-Gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

2.11. Pits and Drains

Every effort should be made to avoid the use of pits, except pits fitted with automatic flammable vapor detecting devices. No drains or blow-off lines shall be directed into or in proximity to sewer systems used for other purposes.

2.12. General Provisions Applicable to Systems in Industrial Plants (of 2,000 gallons water capacity and more) and to Bulk Filling Plants

(a) When standard watch service is provided, it shall be extended to the LP-Gas installation and personnel properly trained.

(b) If loading and unloading are normally done during other than daylight hours, adequate lights shall be provided to illuminate storage containers, control valves and other equipment.

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

(d) To minimize trespassing or tampering, the area which includes container appurtenances, pumping equipment, loading and unloading facilities and cylinder filling facilities shall be enclosed with at least a 6-foot-high industrial type fence unless otherwise adequately protected. There shall be at least two means of emergency access.

2.13. Container Charging Plants

(a) The container charging room shall be located not less than:

1. 10 feet from bulk storage containers.
2. 25 feet from line of adjoining property which may be built upon.

(b)* Tank truck filling station outlets shall be located not less than:

1. 25 feet from line of adjoining property which may be built upon.
2. 10 feet from pumps and compressors if housed in one or more separate buildings.

(c) The pumps or compressors may be located in the container charging room or building, in a separate building, or outside of buildings. When housed in a separate building, such building (a small noncombustible weather cover is not to be construed as a building) shall be located not less than:

1. 10 feet from bulk storage tanks.
2. 25 feet from line of adjoining property which may be built upon.

*Distances given may be reduced when approved by the authority having jurisdiction.

3. 25 feet from sources of ignition.

(d) When a part of the container charging building is to be used for a boiler room or where open flames or similar sources of ignition exist or are employed, the space to be so occupied shall be separated from container charging room by a partition wall or walls of fire resistant construction continuous from floor to roof or ceiling. Such separation walls shall be without openings and shall be joined to the floor, other walls and ceiling or roof in a manner to effect a permanent gastight joint.

(e) Electrical equipment and installations shall conform to B.17 and B.18.

2.14. Fire Protection

(a) Each bulk plant shall be provided with at least one approved portable fire extinguisher having a minimum rating of 12-B,C. Ratings shall be in accordance with the Standard for Installation of Portable Fire Extinguishers, NFPA No. 10.

(b) In industrial installations involving containers of 150,000 gallons aggregate water capacity or more, provision shall be made for an adequate supply of water at the container site for fire protection in the container area, unless other adequate means for fire control are provided. Water hydrants shall be readily accessible and so spaced as to provide water protection for all containers. Sufficient lengths of fire hose shall be provided at each hydrant location on a hose cart, or other means provided to facilitate easy movement of the hose in the container area. It is desirable to equip the outlet of each hose line with a combination fog nozzle. A shelter shall be provided to protect the hose and its conveyor from the weather.

(c) If in the opinion of the authority having jurisdiction, the use of fixed water spray nozzles will better serve to protect the containers and area, these may be specified. The method of release of water spray and alarm facilities shall be at the discretion of the authority having jurisdiction.

2.15. Painting

(a) Aboveground containers shall be kept properly painted.

2.16. Lighting

(a) At the discretion of the authority having jurisdiction, industrial installations shall be lighted. Electrical equipment and installations shall conform to B.17 and B.18.

2.17. Vaporizers for Internal Combustion Engines

- (a) The provisions of 4.7 shall apply.

2.18. Gas Regulating and Mixing Equipment for Internal Combustion Engines

- (a) The provisions of 4.8 shall apply.

DIVISION III. TRUCK TRANSPORTATION OF LIQUEFIED PETROLEUM GAS

Division III applies to the equipment for and requirements for the transportation of liquefied petroleum gas by truck, semi-trailer and trailers. This Division also covers design and construction of cargo tanks permanently mounted on trucks, semi-trailers and trailers, and of skid tanks used as combination transport and storage units. The design and construction of other liquefied petroleum gas containers which are not permanently attached to the truck, semi-trailer, or trailers are not covered. All basic rules apply to this Division unless otherwise noted in the Basic Rules.

Cargo tanks and pertinent equipment for tank vehicles for the transportation of liquefied petroleum gas, in addition to complying with the requirements of this standard, should also comply with the regulations of the Interstate Commerce Commission*** and those of any other regulatory body which may apply.

3.1. Design Pressure and Classification of Cargo Tanks

(a) Containers shall be designed and classified in accordance with Table 7.

Table 7

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gage at 100 F. (37.8 C.)	Minimum Design Pressure of Container lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, and 1965 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 containers of 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, 1959, 1962, and 1965 editions of the ASME Code, and (3) all editions of the API-ASME Code.

***See I.1.(e).

†Construction of containers under the API-ASME Code is not authorized after July 1, 1961.

(b) Longitudinal shell welds shall be located in the upper half of the container.

3.2. Cargo Tank Valves and Accessories

(a) Nonrecessed container fittings and appurtenances shall be protected against damage by either: (1) their location, (2) the vehicle frame or bumper, or (3) a protective housing. The protective housing, if used, shall comply with the requirements under which the tanks are fabricated with respect to design and construction and shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used. The housing shall be provided with a weather cover if necessary to insure proper operation of valves and safety devices.

(b) Filling connections shall be provided with approved automatic back pressure check valves, excess flow check valves or quick closing internal valves to prevent excessive escape of gas in case the filling connection is broken, except that where the filling and discharge connect on a common opening in the container shell, and that opening is fitted with a quick-closing internal valve as specified in Par. 3.2(c), the automatic valve shall not be required. In addition every inlet and outlet connection shall be equipped with a manually or automatically operated shutoff valve.

Liquid discharge openings, except those for engine fuel lines, on tanks built after September 1, 1965 shall be fitted with a remotely controlled internal shutoff valve. Such valve shall conform to the following requirements:

1. The seat of the valve shall be inside the tank, or in the opening nozzle or flange or in a companion flange bolted to the nozzle or flange.

2. All parts of the valve inside the tank, nozzle, or companion flange, shall be made of material not subject to corrosion or other deterioration in the presence of the lading.

3. The arrangement of parts shall be such that damage to parts exterior to the tank will not prevent effective seating of the valve.

4. The valve may be operated normally by mechanical means, by hydraulic means, or by air, or gas pressure.

5. The valve shall be provided with remote means of automatic closure, both mechanical and thermal, in at least two places for tanks over 3,500 gallons water capacity. These remote control stations shall be located at each end of the tank and diagonally op-

posite each other. The thermal control mechanism shall have a fusible element with a melting point not over 220 F. or less than 208 F. At least one remote control station shall be provided for tanks of 3,500 gallons water capacity or less, and such actuating means may be mechanical.

(c) All other connections to containers, except those used for gaging devices, thermometer wells, safety relief devices and plugged openings, shall be provided with suitable automatic excess flow valves, or in lieu thereof may be fitted with quick-closing internal valves.

The control mechanism for the internal valve shall be provided with a secondary control, remote from the fill or discharge connections (for use in the event of accidents or fire during delivery operations), and such control mechanism shall have a fusible element with a melting point not over 220 F. or less than 208 F.

(d) Manually operated shutoff valves, except as covered in B.14(1) and 4.1(a), or self-closing internal valves shall be closed except during transfer operations.

(e) Excess flow valves shall close automatically at the rated flow of vapor or liquid as specified by the valve manufacturers. The flow rating of the piping beyond the excess flow valve shall be greater than that of the excess flow valve and such rating shall include valves, fittings and hose, except, when branching or necessary restrictions are incorporated in such a piping system so that flow ratings are less than that of the excess flow valve at the tank, then additional excess flow valves shall be installed in the piping where such flow rate is reduced.

(f) Container inlets and outlets, except those used for safety relief valves, liquid level gaging devices, and pressure gages, shall be labeled to designate whether they communicate with vapor or liquid space when the container is filled to maximum permitted filling density. Labels may be on valves.

(g) Each cargo tank shall be equipped with a suitable pressure gage.

(h) Any gaging device used to determine the maximum allowable filling limit of a cargo tank of a trailer or semi-trailer shall be located as near the mid-point (front-to-rear) of the cargo tank as practical. If a gaging device, such as a rotary gage or a slip tube gage, is used for the above purpose, a fixed tube gage set in the range of 85-90 per cent of the water capacity of the tank shall be provided, in addition, as a means of checking the accuracy of the variable gage. The capacity indicated by this fixed gage shall be marked on or adjacent

to this gage which shall be secured to prevent tampering with the setting.

(i) An opening shall be provided in each cargo tank to afford complete drainage.

3.3. Piping — including Pipe, Tubing and Fittings

(a) Pipe, tubing and fittings shall be securely mounted and protected against damage and breakage.

(b) Pipe, tubing and fittings shall be suitable for a minimum pressure of 250 psig. Pipe shall be at least Schedule 80 if joints are threaded, or threaded and back welded. At least Schedule 40 (ASTM A-53 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal) shall be used if joints are welded, or welded and flanged.

(c) The use of aluminum alloy pipe, tubing or fittings is prohibited.

(d) Provisions shall be made, in design or by provision of flexible connections, to compensate for stresses and vibration in the piping system. The flexible portion of connectors used for this purpose must not exceed 3 feet in length and shall be installed in accordance with the manufacturer's instructions. Flexible connectors used in the piping of new LP-Gas cargo units built after December 31, 1967 shall be listed or approved flexible metal connectors or fabricated from listed or approved stainless steel or equivalent wire braid reinforced rubber hose with hose couplings suitable for LP-Gas service.

(e) Flexible connectors, on existing LP-Gas cargo units, replaced after December 31, 1967 shall be listed or approved flexible metal connectors or fabricated from listed or approved stainless steel or equivalent wire braid reinforced rubber hose with hose couplings suitable for LP-Gas service.

3.4. Cargo Tank Safety Relief Devices

(a) The discharge from safety relief valves shall be vented away from the container upward and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container. Size of discharge lines from safety relief valves shall not be smaller than the nominal size of the relief valve outlet connection. Suitable provision shall be made for draining condensate which may accumulate in the discharge pipe.

(b) Each discharge outlet from a safety relief valve shall be pro-

vided with a rain cap or other protector to keep water and dirt from collecting in the valve. The protector shall be in place except when the valve operates. The rain cap or other protector shall not reduce the flow through the valve. When a safety relief valve is installed in a well in the top of a container, the well shall be painted or otherwise protected to reduce corrosion, shall be checked frequently and kept free of water and dirt.

(c) Any portion of piping between tank and pump inlet or any wet hose which at any time may be closed at each end should be provided with relief valve to prevent excessive pressure developing.

3.5. Tank Truck Fuel Systems

In the event liquefied petroleum gas is used in the truck engine, the fuel system shall be installed in accordance with Division IV.

3.6. Transfer of Liquids

(a) The determination of the maximum permitted filling when loading cargo tanks on trucks, trailers or semi-trailers shall be by the use of suitable liquid level gage or by weighing whether or not a meter is used (see B.12 and B.19).

(b) Pumps or compressors shall be designed for use with LP-Gas; they shall be properly protected and may be mounted upon liquefied petroleum gas tank trucks, trailers, or semi-trailers and may be driven by the truck motor power take-off or internal combustion engine, hand, mechanical, hydraulic or electrical means. On electrical means of pumping, the electrical installation shall be in accordance with the requirements of the National Electrical Code for Class I, Group D, Hazardous Locations.

(c) When hose is carried connected to truck liquid pump discharge piping, an automatic device such as a differential regulator or equivalent device shall be installed between the pump discharge and the hose connection to prevent liquid discharge when the pump is not running. When a meter is used, the device shall be installed between the meter outlet and the hose connection. An excess flow valve may also be used but shall not be used as the exclusive means to accomplish the requirements of this paragraph.

3.7. Mounting Cargo Tanks on Vehicles

(a) Tank motor vehicles with frames not made integral with the tank, as by welding, shall be provided with turnbuckles or similar positive devices for drawing the tank down tight on the frame. In addition, suitable stops or anchors shall be attached to the frame

and/or the tank to prevent relative motion between them due to starting, stopping, and turning. The stops and anchors shall be so installed as to be readily accessible for inspection and maintenance.

(b) Any tank motor vehicle designed and constructed so that the cargo tank constitutes in whole or in part the stress member used in lieu of a frame shall be supported by external cradles subtending at least 120 degrees of the shell circumference. The design calculations shall include beam stress, shear stress, torsion stress, bending moment and acceleration stress for the cargo tank as a whole using a factor of safety of four, based on the ultimate tensile strength of the material. Maximum concentrated stresses which might be created at pads and cradles due to shear, bending and torsion shall also be calculated in accordance with Appendix G of the ASME Unfired Pressure Vessel Code, 1965 Edition. Fully loaded vehicles shall be assumed to be operating under highway conditions equal to 2 "g" loading. The effects of fatigue shall be taken into consideration. Cargo tanks mounted on frames may be supported by longitudinal members attached to pads providing the above-stated factors are taken into account.

(c) Where any tank support is attached to any part of a tank head, the stresses imposed upon the head shall be provided for as required in 3.7(b).

(d) Tank supports, stops, anchors and bumpers shall not be welded directly to the tank but shall be attached by means of pads of the same material as the tank. The pad thickness shall be not less than $\frac{1}{4}$ inch, or the thickness of the shell material if less, and no greater than the shell material. Each pad shall extend at least 4 times its thickness, in each direction, beyond the weld attaching the support, bumper, stop or anchor. Each pad shall be performed to an inside radius no greater than the outside radius of the tank at the place of attachment. Each pad corner shall be rounded to a radius at least $\frac{1}{4}$ the width of the pad, and no greater than $\frac{1}{2}$ the width of the pad. Weep holes and tell-tale holes, if used, shall be drilled or punched before the pads are attached to the tank. Each pad shall be attached to the tank by continuous fillet welding using filler material having properties conforming to the recommendations of the maker of the shell and head material.

3.8. Electrical Equipment and Lighting

Trucks, trailers, and semi-trailers shall not be equipped with any artificial light other than electrical. Lighting circuits shall have suitable over-current protection (fuses or automatic circuit breakers);

the wiring shall have sufficient carrying capacity and mechanical strength, and shall be suitably secured, insulated and protected against physical damage.

3.9. Trailers and Semi-Trailers

(a) Trailers shall be firmly and securely attached to the vehicle drawing them by means of suitable drawbars, supplemented by safety chains.

(b) Every trailer or semi-trailer shall be equipped with a reliable system of brakes, and adequate provision shall be made for its efficient operation from the driver's seat of the vehicle drawing the trailer.

(c) Every trailer or semi-trailer shall be provided with side lights and a tail light.

(d) Four-wheeled trailers shall be of a type of construction which will prevent the towed vehicle from whipping or swerving from side to side dangerously and will cause it to follow substantially in the path of the towing vehicle.

(e) When a fifth wheel is employed, it shall be ruggedly designed, securely fastened to both units, and equipped with a positive locking mechanism which will prevent separation of the two units, except by manual release.

(f) Any loaded cargo tank trailer or cargo tank semi-trailer when parked shall be so positioned that the safety relief valve shall communicate with the vapor space of the container.

3.10. Metallic Connections

Cargo tank, chassis, axles and springs shall be metallically connected.

3.11. Exhaust Systems

(a) The exhaust system, including muffler and exhaust line, shall have ample clearance from the fuel system and combustible materials. Truck exhaust discharge shall be directed away from any tank and appurtenances and to the outside of the frame and any skirting.

(b) Muffler cutout shall not be used.

3.12. Extinguishers Required

Each tank truck or tractor shall be provided with at least one approved portable fire extinguisher having at least a 12-B,C rating or when more than one is provided, each extinguisher shall have at least a 6-B,C rating. Each truck transporting cylinders shall have at least one extinguisher having an 8-B,C rating. Ratings shall be in accordance with the Standard for Installation of Portable Fire Extinguishers, NFPA No. 10.

3.13. Smoking Prohibited

Truck drivers and their helpers shall not smoke or allow smoking around the truck on the road, while making deliveries, filling the trucks or making any repairs to truck or trailer.

3.14. Protection Against Collision

Each truck and trailer shall be provided with properly attached steel bumpers or chassis extension which shall be so arranged as to protect any tank, piping, valves and fittings in case of collision.

3.15. Chock Blocks for Tank Vehicles

Each tank truck and trailer shall carry chock blocks which shall be used to prevent rolling of the vehicle whenever it is parked, including when loading and unloading.

3.16. Painting Cargo Tanks on Vehicles

At least the upper two-thirds of cargo tanks shall be painted with a light reflecting paint for the finish coat except for lettering.

3.17. Marking Cargo Vehicles

Every tank vehicle used for the transportation of liquefied petroleum gas shall be marked on each side and rear, thereof, on a sharply contrasting background, with **FLAMMABLE COMPRESSED GAS** or **FLAMMABLE GAS** in block letters at least three inches high, and in block letters at least two inches high, **LIQUEFIED PETROLEUM GAS**, or **BUTANE** or **PROPANE** as appropriate.

3.18. Transportation of Portable Containers

(a) Portable containers transported in vehicles shall be secured to prevent movement, tipping over, or physical damage. Valves shall be safeguarded against physical damage due to collision or overturning.

1. Containers not exceeding 200 pounds water capacity may be transported in other than upright position.

2. Containers in excess of 200 pounds water capacity shall be transported with relief valves in direct communication with the vapor space of the container.

3.19. Transportation of Division II Containers or Systems

(a) Containers not considered portable which are not designed for transportation and not permanently attached to the vehicle, shall be properly secured against movement during transportation. Such containers shall contain no more LP-Gas than 5 per cent of their water capacity during transportation. The containers shall be braced or otherwise secured on the vehicle to prevent relative motion while in transit. However, containers which contain more LP-Gas than 5 per cent of their water capacity may be transported subject to such limitations as may be specified by the authority having jurisdiction.

(b) Valves, regulating, and other tank accessory equipment shall be adequately protected against physical damage during transportation.

(c) Lifting lugs on containers covered by 3.19(a) shall not be used as the exclusive means of lifting such containers.

3.20. Movable Fuel Storage Tenders or Farm Carts

(a) Applicable Basic Rules shall apply to these units.

(b) Valves, piping, fittings and accessories shall be adequately safeguarded against physical damage due to collision or upset.

(c) Threaded piping shall be not less than Schedule 80 and fittings shall be designed for not less than 250 psig.

(d) These units shall not be refilled on a public road or highway.

3.21. Parking and Garaging LP-Gas Tank Vehicles

(a) Tank vehicles containing LP-Gas, except in an emergency and except as provided in 3.21(b), shall not be left unattended on any street, highway, avenue or alley, provided that this shall not prevent a driver from the necessary absence from the vehicle in connection with a delivery, nor shall it prevent stops for meals or rest stops during the day or night if the vehicle is well lighted at point of parking.

(b) Unattended tank trucks containing LP-Gas, shall not be parked in congested areas. Such vehicles may be parked off the street in uncongested areas if at least 50 feet from any building used for assembly, institutional or multiple residential occupancy. This is not intended to prohibit the parking of delivery tank trucks of 3,500 gallons water capacity or less on streets adjacent to the driver's residence in uncongested residential areas provided such points are at least 50 feet from a building used for assembly, institutional or multiple residential occupancy.

(c) Tank vehicles containing LP-Gas shall not be stored, parked or garaged in any building unless the building is specifically approved for such use by the authority having jurisdiction or is designed for such use.

(d) The following essential precautions shall be followed when it is necessary to garage LP-Gas tank vehicles for service on the chassis or engine:

1. All primary shutoff valves shall be closed and liquid and vapor in the hose and piping vented to a safe location prior to moving the vehicle into the building.

2. The system shall be checked for any leaks and any found shall be repaired before the vehicle is moved inside of the building.

3. The cargo container shall be gaged to determine that it is not filled beyond maximum filling capacity according to Paragraph B.12(a). If over-filled, it shall be corrected before the vehicle is moved inside of the building.

4. The vehicle shall not be parked near a source of heat, open flames or similar sources of ignition or within the path of hot air being blown from a blower type heater.

5. Unless the product is removed from the cargo tank and the pressure reduced to atmospheric, the driver shall instruct the responsible people in the garage of the nature of the cargo contents and instruct them not to tamper with the tank valves or fittings.

(e) Repair work shall not be done on the cargo container or primary shutoff valves while the vehicle is in the garage if the cargo container contains product.

DIVISION IV. LIQUEFIED PETROLEUM GAS AS A MOTOR FUEL

Division IV applies to internal combustion engines, fuel containers and pertinent equipment for the use of liquefied petroleum gases as a motor fuel on easily movable, readily portable units including self-propelled vehicles.

Fuel containers and pertinent equipment for internal combustion engines using liquefied petroleum gas where installation is of the stationary type are covered by Division II of this Standard. Division IV does not apply to containers for transportation of liquefied petroleum gases nor to marine fuel use. All Basic Rules apply to this Division, unless otherwise noted in the Basic Rules.

4.1. General

(a) Fuel may be used from the cargo tank of a truck while in transit, but not from cargo tanks on trailers or semi-trailers. The use of fuel from the cargo tanks to operate stationary engines is permitted providing wheels are securely blocked.

(b) Passenger-carrying vehicles shall not be fueled while passengers are on board.

(c) Industrial trucks (including lift trucks) equipped with permanently mounted fuel containers shall be charged outdoors. Charging equipment shall comply with the provisions of Division VIII.

(d) LP-Gas fueled industrial trucks shall comply with the Standard for Type Designations, Areas of Use, Maintenance and Operation of Powered Industrial Trucks, NFPA No. 505.

(e) Engines on vehicles shall be shut down while fueling if the fueling operation involves venting to the atmosphere.

4.2. Design Pressure and Classification of Fuel Containers

(a) Except as covered in 4.2(b) and 4.2(c) containers shall be in accordance with Table 8.

(b) Fuel containers for use in industrial trucks (including lift trucks) shall be either ICC* containers authorized for LP-Gas service having a minimum service pressure of 240 psig or minimum

*See I.1.(c).

Table 8

*Minimum Design Pressure of
Container lb. per sq. in. gage
1949 edition of ASME
Code (Par. U-200, U-201);
1950, 1952, 1956, 1959, 1962,
and 1965 editions of
ASME Code,
All editions of
API-ASME Code†*

<i>Container Type</i>	<i>For Gases with Vapor Press. Not to Exceed lb. per sq. in. gage at 100 F. (37.8 C.)</i>	<i>1949 and earlier editions of ASME Code (Par. U-68, U-69)</i>
200*	215	200

250

*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, 1959, 1962, and 1965 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, 1961.

Container Type 250.* Under 1950 and later ASME Codes, this means a 312.5 psig design pressure container.

(c) Containers manufactured and maintained under Interstate Commerce Commission** specifications and regulations may be used as fuel containers. When so used they shall conform to all rules in this Division.

(d) All container inlets and outlets except safety relief valves and gaging devices shall be labeled to designate whether they communicate with vapor or liquid space. Labels may be on valves.

4.3. Installation of Fuel Containers

(a) Containers shall be located in a place and in a manner to minimize the possibility of damage to the container. Containers located in the rear of trucks and buses, when protected by substantial bumpers, will be considered in conformance with this requirement. Fuel containers on passenger carrying vehicles shall be installed as far from the engine as is practicable, and the passenger space and any space containing radio equipment shall be sealed from the container space to prevent direct seepage of gas to these spaces. The container compartment shall be vented to the outside. In case the fuel container is mounted near the engine or the exhaust system, the container shall be shielded against direct heat radiation.

**See I.1.(c).

(b) Containers shall be installed with as much clearance as practicable but never less than the minimum road clearance of the vehicle under maximum spring deflection. This minimum clearance shall be to the bottom of the container or to the lowest fitting on the container or housing, whichever is lower.

(c) Permanent and removable fuel containers shall be securely mounted to prevent jarring loose, slipping or rotating, and the fastenings shall be designed and constructed to withstand static loading in any direction equal to twice the weight of the tank and attachments when filled with fuel using a safety factor of not less than four based on the ultimate strength of the material to be used. Field welding, when necessary, shall be made only on saddle plates, lugs, or brackets, originally attached to the container by the tank manufacturer.

(d) Fuel containers on buses shall be permanently installed.

(e) Containers from which vapor only is to be withdrawn shall be installed and equipped with suitable connections to minimize the accidental withdrawal of liquid.

4.4. Valves and Accessories

(a) Container valves and accessories shall have a rated working pressure of at least 250 psig, and shall be of a type suitable for liquefied petroleum gas service.

(b) The filling connection [see B.7(h)] shall be fitted with an approved double back-pressure check valve, or a positive shutoff in conjunction with an internal back-pressure check valve. On a removable container the filler valve may be a hand operated shutoff valve with an internal excess flow valve. Main shutoff valves on the container on liquid and vapor lines must be readily accessible.

(c) With the exceptions of 4.4(d)3, filling connections equipped with approved automatic back-pressure check valves, and safety relief valves, all connections to containers having openings for the flow of gas in excess of a No. 54 drill size shall be equipped with approved automatic excess flow valves to prevent discharge of content in case connections are broken. This requirement may be waived when such exception is recognized by the testing and listing of the containers and fittings by any of the authorities listed in B.2.

(d) Liquid level gaging devices:

1. Variable liquid level gages which require the venting of fuel to the atmosphere shall not be used on fuel containers of industrial trucks (including lift trucks).

2. Permanently mounted fuel containers shall be equipped with a fixed length dip tube gage, in accordance with Appendix E.

3. In the case of containers used solely in farm tractor service, and charged at a point at least 50 feet from any important building, the fixed liquid level gaging device may be so constructed that the outward flow of container content exceeds that passed by a No. 54 drill size opening, but in no case shall the flow exceed that passed by a No. 31 drill size opening. An excess flow valve is not required. Fittings equipped with such restricted drill size opening and container on which they are used shall be marked to indicate the size of the opening.

(e) All valves and connections on containers shall be adequately protected to prevent damage due to accidental contact with stationary objects or from loose objects thrown up from the road, and all valves shall be safeguarded against damage due to collision, overturning or other accident. For farm tractors where parts of the vehicle provide such protection to valves and fittings, the foregoing requirements shall be considered fulfilled. However, on removable type containers the protection for the fittings shall be permanently attached to the container.

(f) Exchange of removable fuel containers preferably should be done outdoors but may be done indoors. When removable fuel containers are used, means shall be provided in the fuel system to minimize the escape of fuel when the containers are exchanged. This may be accomplished by either of the following methods:

1. Using an approved automatic quick-closing coupling (a type closing in both directions when uncoupled) in the fuel line, or
2. Closing the valve at the fuel container and allowing the engine to run until the fuel in the line is consumed.

4.5. Piping — including Pipe, Tubing and Fittings

(a) Pipe from fuel container to first stage regulator shall be not less than Schedule 80 wrought iron or steel (black or galvanized), brass or copper; or seamless copper, brass or steel tubing. Steel tubing shall have a minimum wall thickness of 0.049 inches. Steel pipe or tubing shall be adequately protected against exterior corrosion. Copper tubing shall be Type K or L or equivalent having a minimum wall thickness of 0.032 inches. Approved flexible connections (see B.9) may be used between container and regulator or between regulator and gas-air mixer within the limits of approval by any of the authorities listed in B.2(a). The use of aluminum pipe or tubing is prohibited. In the case of removable containers an approved flexible connection shall be used between the container and the fuel line.

(b) All piping shall be installed, braced and supported so as to reduce to a minimum the possibility of vibrations, strains or wear.

4.6. Safety Devices (Refer also to B.10)

(a) Spring-loaded internal type safety relief valves shall be used on all motor fuel containers.

(b) The discharge outlet from safety relief valves shall be located on the outside of enclosed spaces and as far as practicable from possible sources of ignition, and vented upward in such a manner as to prevent impingement of escaping gas upon containers, or parts of vehicle, or on vehicles in adjacent lines of traffic. A rain cap, or other protector, shall be used to keep water and dirt from collecting in the valve.

(c) When a discharge line from the container safety relief valve is used, the line shall be metallic, other than aluminum, and shall be sized, located and maintained so as not to restrict the required flow of gas from the safety relief valve. Such discharge line shall be able to withstand the pressure resulting from the discharge of vapor when the safety relief valve is in the full open position. When flexibility is necessary, flexible metal hose or tubing shall be used.

(d) See B.10(j) for hydrostatic relief valves.

4.7. Vaporizers

(a) Vaporizers and any part thereof and other devices that may be subjected to container pressure, shall have a design pressure of at least 250 psig.

(b) Each vaporizer shall have a valve or suitable plug which will permit substantially complete draining of the vaporizer. It shall be located at or near the lowest portion of the section occupied by the water or other heating medium.

(c) Vaporizers shall be securely fastened so as to minimize the possibility of becoming loosened.

(d) Each vaporizer shall be permanently marked at a visible point as follows:

1. With design pressure of the fuel containing portion in psig.
2. With the water capacity of the fuel containing portion of the vaporizer in pounds.

(e) Devices to supply heat directly to a fuel container shall be equipped with an automatic device to cut off the supply of heat before the pressure inside the fuel container reaches 80 per cent of

the start to discharge pressure setting of the safety relief device on the fuel container.

(f) Exhaust gases shall not be used as a direct means of heat supply for the vaporization of fuel.

(g) Vaporizers shall not be equipped with fusible plugs.

4.8. Gas Regulating and Mixing Equipment

(a) Approved automatic pressure reducing equipment shall be installed in a secure manner between the fuel supply container and gas-air mixer for the purpose of reducing the pressure of the fuel delivered to the gas-air mixer.

(b) An approved automatic shutoff valve shall be provided in the fuel system at some point ahead of the inlet of the gas-air mixer, designed to prevent flow of fuel to the mixer when the ignition is off and the engine is not running. In the case of industrial trucks and engines operating in buildings other than those used exclusively to house engines, the automatic shutoff valve shall be designed to operate if the engine should stop. Atmospheric type regulators (zero governors) shall be considered adequate as an automatic shutoff valve only in cases of outdoor operation such as farm tractors, construction equipment, irrigation pump engines, and other outdoor stationary engine installations.

(c) The source of the air for combustion shall be completely isolated from the passenger compartment, ventilating system or air conditioning system.

4.9. Capacity of Containers

(a) No single fuel container used on passenger carrying vehicles shall exceed 200 gallons water capacity. No single fuel container on other vehicles normally operating on the highway shall exceed 300 gallons water capacity except as provided in 4.1(a).

4.10. Stationary Engines in Buildings

(a) Stationary engines and gas turbines installed in buildings, including portable engines used instead of or to supplement stationary engines, shall comply with the Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA No. 37, and the appropriate provisions of the Basic Rules, Division I and Division II. See 4.12.

4.11. Portable Engines in Buildings (See 4.12 for Industrial Trucks)

- (a) Portable engines may be used in buildings only for emergency use, except as provided by 4.10(a).
- (b) Exhaust gases shall be discharged to outside the building or to an area where they will not constitute a hazard.
- (c) Provision shall be made to supply sufficient air for combustion and cooling.
- (d) An approved automatic shutoff valve shall be provided in the fuel system ahead of the engine, designed to prevent flow of fuel to the engine when the ignition is off or if the engine should stop.
- (e) The capacity of LP-Gas containers used with such engines shall comply with the applicable occupancy provision of 1.4.

4.12. Industrial Trucks Inside Buildings

- (a) LP-Gas fueled industrial trucks are permitted to be used in buildings and structures.
- (b) No more than two (2) LP-Gas containers shall be used on an industrial truck for motor fuel purposes.
- (c) Subject to approval by the authority having jurisdiction, LP-Gas fueled industrial trucks are permitted to be used in buildings frequented by the public, when occupied by the public. The total water capacity of containers on each industrial truck shall not exceed 105 pounds (nominal 45 pounds LP-Gas).
- (d) Trucks shall not be left unattended in areas occupied by the public.

4.13. Garaging LP-Gas Fueled Vehicles (See also 3.21.)

- (a) LP-Gas fueled vehicles may be stored or serviced inside garages provided there are no leaks in the fuel system and the fuel tanks are not filled beyond the maximum filling capacity of B.12(a).
- (b) LP-Gas fueled vehicles being repaired in garages shall have the container shutoff valve closed except when fuel is required for engine operation.
- (c) Such vehicles shall not be parked near sources of heat, open flames or similar sources of ignition or near open pits unless such pits are adequately ventilated.

DIVISION V. STORAGE OF CONTAINERS AWAITING USE OR RESALE

This Division shall apply to the storage of portable containers not in excess of 1,000 lbs. water capacity, filled or partially filled, at user location but not connected for use, or in storage for resale by dealers or resellers. This Division shall not apply to containers stored at charging plants or at plants devoted primarily to the storage and distribution of LP-Gas or other petroleum products.

5.1. General

(a) Containers in storage shall be located so as to minimize exposure to excessive temperature rise, physical damage, or tampering by unauthorized persons.

(b) Containers when stored inside shall not be located near exits, stairways or in areas normally used or intended for the safe exit of people.

(c) Containers (empty or filled) which require valve protecting caps shall have such caps in place while in storage.

(d) The outlet valves of containers in storage shall be closed.

(e) Empty containers which have been in LP-Gas service should preferably be stored in the open. When stored inside, they shall be considered as full containers for the purpose of determining the maximum quantity of LP-Gas permitted by this Division.

5.2. Storage within Buildings Frequented by the Public

(a) ICC specification containers having a maximum individual water capacity of 2½ pounds, used with completely self-contained hand torches and similar applications, are permitted to be stored or displayed in a building frequented by the public. The display of such containers shall be limited to a total of 24 units of each brand and size. The total quantity on display and in storage shall not exceed 200 pounds LP-Gas.

(b) Storage as provided in 5.4 shall not be permitted within or attached to such a building.

5.3. Storage within Buildings not Frequented by the Public (such as industrial buildings)

(a) The quantity of LP-Gas stored shall not exceed 300 pounds (approximately 2,550 cubic feet in vapor form) except as provided in Par. 5.4.

(b) Containers carried as a part of service equipment on highway mobile vehicles are not to be considered in the total storage capacity in 5.3(a) above provided such vehicles are stored in private garages, and are limited to one container per vehicle with an LP-Gas capacity of not more than 100 pounds. All container valves shall be closed.

5.4. Storage within Special Buildings or Rooms

(a) The quantity of LP-Gas stored in special buildings or rooms shall not exceed 10,000 pounds.

(b) The walls, floors and ceilings of container storage rooms that are within or adjacent to other parts of the building shall be constructed of material having at least a two-hour fire resistance rating.

(c) A portion of the exterior walls or roof having an area not less than 10 per cent of that of the combined area of the enclosing walls and roof, shall be of single strength glass or other similar explosion relieving construction. See Guide for Explosion Venting, NFPA No. 68, for details.

(d) Each opening from such storage rooms to other parts of the building shall be protected by a 1½ hour (B) listed fire door. See Standard for Fire Doors and Windows, NFPA No. 80.

(e) Such rooms shall have no open flames for heating or lighting.

(f) Such rooms shall be adequately ventilated both top and bottom to the outside only. The openings from such vents shall be at least 5 feet away from any other opening into any building.

(g) The floors of such rooms shall not be below ground level. Any space below the floor shall be of solid fill or properly ventilated to the open air.

(h) Such storage rooms shall not be located adjoining the line of property occupied by schools, churches, hospitals, athletic fields or other points of public gathering.

(i) Fixed electrical equipment shall be installed in accordance with B.18.

5.5. Storage Outside of Buildings

(a) Storage outside of buildings, for containers awaiting use or resale shall be located in accordance with Table 9 with respect to:

1. Nearest important building or group of buildings.
2. Line of adjoining property which may be built upon.

3. Busy thoroughfares.

4. Line of adjoining property occupied by schools, churches, hospitals, athletic fields, or other points of public gathering.

Table 9

<i>Quantity of LP-Gas Stored</i>	<i>Distance</i>
500 lbs. or less	0
501 to 2,500 lbs.	0*
2501 to 6,000 lbs.	10 ft.
6001 to 10,000 lbs.	20 ft.
Over 10,000 lbs.	25 ft.

*Container or containers shall be at least 10 feet from any building on adjoining property, any sidewalk or any of the exposures described in 5.5(a) 3 or 4.

(b) Containers shall be in a suitable enclosure or otherwise protected against tampering.

(c) Valves and safety relief devices shall be protected against accumulations of ice and snow. Protective caps shall be deemed adequate.

(d) When the provisions of 5.5(a), (b), or (c), are impractical at construction sites or buildings and structures undergoing major renovation, the storage of containers shall be acceptable to the authority having jurisdiction.

5.6. Fire Protection

Storage locations other than supply depots separated and located apart from dealer, reseller, or user establishment, shall be provided with at least one approved portable fire extinguisher having a minimum rating of 8-B,C. Ratings shall be in accordance with the Standard for Installation of Portable Fire Extinguishers, NFPA No. 10.

DIVISION VI.

LP-GAS EXCHANGEABLE READILY PORTABLE CONTAINER SYSTEM INSTALLATIONS ON TRAVEL TRAILERS, CAMPER TRAILERS, SELF-PROPELLED CAMPERS, OR MOBILE HOMES

Division VI applied to exchangeable, readily portable container LP-Gas systems on travel trailers, camper trailers, self-propelled campers or mobile homes. All Basic Rules apply to Division VI unless otherwise noted.

Individual containers mounted on such vehicles shall be limited to 105 pounds water capacity (approximately 45 pounds LP-Gas capacity). Commercial vehicles and vehicles using either larger exchangeable type or permanently mounted containers are covered in Division VII. When such vehicles are permanently parked and LP-Gas is supplied from a container not mounted on and secured to the unit, Divisions I or II shall apply.

6.1. Construction of Containers

(a) Containers shall be constructed in accordance with the specifications of the Interstate Commerce Commission* except as provided in (b).

(b) Containers constructed according to the requirements of the ASME or API-ASME Unfired Pressure Vessel Codes (see B.3) shall be acceptable provided they comply with all other requirements set forth in this Division. ASME containers constructed after December 31, 1967 shall be Type 250 [see 2.1(a)].

(c) Design of container shall provide for vapor withdrawal in accordance with 6.7(a) when connected for use (i.e., in horizontal, near horizontal or vertical position). Design shall provide for installation of necessary accessories, and for the system requirements of 6.3 and 6.8, and shall be such as to minimize the possibility of liquid entering the vapor outlet, whether the vehicle is parked or in motion.

6.2. Marking of Containers

All containers except those included in 6.1(b) shall be marked in accordance with the Interstate Commerce Commission* regula-

*See I.1.(c).

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tions. Additional markings not in conflict with Interstate Commerce Commission* regulations may be used.

6.3. Description of Division VI System

A Division VI System shall include any or all of the following: container bracket(s) or support(s), container(s), container valve(s), manifold valve assembly (two container systems), regulator(s) and relief valve(s). Systems may be designed for either vertical, horizontal or near horizontal container mounting [see 6.5(c)].

6.4. Location of Containers and Systems

(a) Containers shall not be installed, transported, or stored (even temporarily) inside any vehicle covered by Division VI except for listed, completely self-contained hand torches, lanterns or similar equipment with containers having a water capacity not exceeding 2½ pounds.

(b) Containers, control valves, and regulating equipment comprising a complete system shall be mounted:

1. On the chassis as close to the hitch as practicable; or
2. In a recess that is gastight to the inside of the mobile home or travel trailer and accessible only from the outside. The recess shall be ventilated at top and bottom to facilitate diffusion of vapors.

(c) Systems mounted on the trailer hitch shall be so located that the discharge from safety relief devices shall be not less than three feet horizontally away from any opening into the mobile unit below the level of such discharge. When system is located in a ventilated recess, vent openings in such recess shall be not less than three feet horizontally away from any opening into the mobile unit below the level of these vents.

6.5. Container Valves and Accessories

(a) Valves in the assembly of a two-cylinder system shall be arranged so that replacement of containers can be made without shutting off the flow of gas to the appliances.

NOTE: This provision is not to be construed as requiring an automatic change-over device.

(b) Shutoff valves on the containers shall be protected in transit, in storage, and while being moved into final utilization as follows:

1. By setting into a recess of the container to prevent possibility of being struck if container is dropped upon a flat surface, or,

*See I.1.(e).

2. By a ventilated cap or collar fastened to the container capable of withstanding a blow from any direction equivalent to that of a 30 pound weight dropped 4 feet. Construction must be such that a blow will not be transmitted to the valve.

(c) Container openings for vapor withdrawal shall be located in the vapor space when the container is in service or shall be provided with a suitable internal withdrawal tube which communicates with the vapor space in or near the highest point in the container when it is mounted in service position, with the vehicle on a level surface. Containers shall be permanently and legibly marked in a conspicuous manner on the outside to show the correct mounting position and the position of the service outlet connection. The method of mounting in place shall be such as to minimize the possibility of an incorrect positioning of the container.

6.6. Safety Relief Devices

(a) ICC* containers shall be provided with safety relief devices as required by the Regulations of the Interstate Commerce Commission.*

(b) Containers constructed in accordance with the rules of the ASME or the API-ASME shall be provided with safety relief devices as required by B.10.

(c) The delivery side of the gas pressure regulator shall be equipped with a safety relief device which is set to start to discharge at a pressure not less than two times and not more than three times the delivery pressure of the regulator.

6.7. System Design and Service Line Pressure

(a) Systems shall be of the vapor-withdrawal type.

(b) Pressure of the vapor in piping downstream of the regulator supplying appliances shall not exceed 18 inches water column.

6.8. System Enclosure and Mounting

(a) Housings or enclosures shall be designed to provide proper ventilation.

(b) Doors, hoods, domes, or portions of cabinets, required to be removed or opened for replacement of containers shall incorporate means for clamping them firmly in place, and prevent them from working loose during transit.

NOTE: Locks, if used, should be of the frangible shank type.

*See I.1.(e).

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(c) Provisions shall be incorporated in the assembly to hold the containers firmly in position and prevent their movement during transit in accordance with 4.3(c).

(d) Containers and appurtenances shall be protected against damage by (1) their location, (2) the vehicle frame or bumper, or (3) a protective housing.

6.9. Piping — including Pipe, Tubing and Fittings

(a) Regulators shall be connected directly to cylinder valve outlets or mounted securely by means of a support bracket and connected to the cylinder valve or valves with listed high pressure flexible connections.

(b) Provision shall be made between the regulator outlet and the gas service line by either a flexible connector or a tubing loop to provide for expansion, contraction, jarring and vibration.

(c) Pipe, tubing and fittings shall conform to B.8 except that the use of aluminum alloy piping, other than listed aluminum appliance connectors, is prohibited. Steel tubing shall have a minimum wall thickness of 0.049 inches. Steel pipe or tubing shall be adequately protected against exterior corrosion.

(d) Approved gas tubing fittings shall be employed for making tubing connections.

(e) The gas line shall be firmly fastened in a protected location under the vehicle and outside and below any insulation or false bottom. Fastenings shall be such as to prevent abrasion or damage to the fuel line from vibration. Where the gas line passes through structural members or floors, a rubber grommet or equivalent shall be installed to prevent chafing.

(f) The gas line shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance which it serves. Where a branch line is required, the tee connection shall be in the main gas line and located under the vehicle.

(g) All parts of the system assembly shall be so designed and secured as to preclude such parts working loose during transit.

6.10. Test of Piping for Tightness

(a) Before appliances are connected, piping systems shall stand a pressure of at least 6 inches mercury or 3 pounds gage for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a mercury manometer or slope

gage, or an equivalent device calibrated so as to be read in increments of not greater than one-tenth pound. The source of pressure shall be isolated before the pressure tests are made.

(b) When appliances are connected to the piping system, the entire system shall stand a pressure of not less than 10 inches water column for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a water manometer or an equivalent device calibrated so as to be read in increments of not greater than one-tenth inch water column. The source of pressure shall be isolated before the pressure tests are made.

6.11. Appliances

(a) LP-Gas appliances shall be approved for use in a travel trailer or mobile home.

(b) Gas-fired heating appliances, including water heaters, shall be designed or installed to provide for complete separation of the combustion system from the atmosphere of the living space. Such appliances shall be installed with the combustion air inlet assembly furnished as a component of the appliance and, also, with either (1) the flue gas outlet assembly furnished as a component of the appliance, or (2) a listed roof jack if the appliance is listed for such use.

The combustion air inlet assembly, flue gas outlet, assembly, and roof jack shall extend to the outside atmosphere.

(c) Except for range top burner sections and gas lights, all gas-fired appliances shall be provided with an automatic pilot device. Such automatic pilot devices, except range oven and broiler units, shall be of the complete shutoff type.

(d) Appliances shall be located inside a vehicle in such a manner that a fire at an appliance will not block egress of persons therefrom.

6.12. General Precautions

(a) Containers, except those covered in 6.1(b), shall be marked, maintained and requalified in accordance with the regulations of the Interstate Commerce Commission.*

(b) Requalification of containers for continued service is the responsibility of the owner; containers shall be stamped with the date of requalification. When ICC* cylinders are requalified by retesting, such retests shall be made in accordance with ICC Regulations.*

*See I.1.(e).

(c) Containers shall not be charged with fuel unless they bear the proper markings of the code under which they were fabricated, and are marked with the water capacity and tare weight in pounds.

(d) ICC* containers which have been involved in a fire shall not be refilled until they have been requalified for service according to ICC Regulations.*

(e) ASME or API-ASME containers which have been involved in a fire shall not be refilled until they have been retested in accordance with the requirements for their original hydrostatic test and found to be suitable for continued service.

(f) Containers shall not be charged without the consent of the owner thereof.

(g) A permanent caution tag shall be provided by the manufacturer in accordance with Installations of Plumbing, Heating, and Electrical Systems in Mobile Homes, USA Standard A119.1 — 1963 or Installations of Plumbing, Heating, and Electrical Systems in Travel Trailers, USA Standard A119.2 — 1963.** This tag shall be outside of any enclosure, attached to the outside of the exterior wall close to the gas supply connection, or near the inlet of the gas piping leading inside the mobile unit and adjacent to the container. Such tag shall be conspicuously and legibly inscribed with substantially the following:

1. For systems designed for use with LP-Gas only, tag shall read:

(a) This system is designed for use with LP-Gas only. Do not connect natural gas to this system.

(b) Securely cap gas inlet into the mobile unit when gas system is disconnected from gas supply.

(c) BEFORE TURNING ON GAS, MAKE CERTAIN ALL GAS CONNECTIONS HAVE BEEN MADE TIGHT, ALL APPLIANCE VALVES ARE TURNED OFF, AND ANY UNCONNECTED OUTLETS ARE CAPPED.

(d) After turning on gas, except after normal container replacement, test piping and appliances for leaks using a manometer or equivalent device. Locate any leak with soapy water — do not use open flame. Do not leave containers connected unless system has been proven to be gastight.

*See I.1.(e).

**Available from Mobile Homes Manufacturers Association, 20 North Wacker Drive, Chicago, Illinois 60606.

2. For combination systems designed for use with either LP-Gas or natural gas, tag shall read:

(a) This system is designed for use with either LP-Gas or natural gas.

(b) Securely cap gas inlet into mobile unit when gas system is disconnected from gas supply.

(c) Before turning on gas, be certain appliances are suitable for gas to be used, and are equipped with correct orifices.

(d) BEFORE TURNING ON GAS, MAKE CERTAIN ALL GAS CONNECTIONS HAVE BEEN MADE TIGHT, ALL APPLIANCE VALVES ARE TURNED OFF, AND ANY UNCONNECTED OUTLETS ARE CAPPED.

(e) After turning on gas, except after normal container replacement, test piping and appliances for leaks using a manometer or equivalent device. Locate leaks with soapy water — do not use open flame. Do not leave system turned on or containers connected until system has been proven to be gastight.

6.13. Charging of Containers

(a) Containers shall be charged in accordance with B.12 and one of the following:

1. At a properly equipped container charging plant which complies with all applicable requirements of this standard.

2. At a trailer court location directly from a tank truck into the containers installed at any one vehicle with the following limitations.

(a) Containers with water capacities in excess of 50 pounds (approximately 21 pounds LP-Gas capacity) shall be provided with excess flow or back flow check valves to prevent the discharge of container contents in case of failure of the filling connections.

(b) Vapor or liquid shall not be vented to the atmosphere to aid in charging the container.

(c) The container charging operation shall be performed only by qualified personnel.

3. When containers are accumulated at the tank truck for charging, such charging shall not be done within 50 feet of the nearest building, camper, trailer, self-propelled camper, mobile home or group of buildings, nor within 25 feet of public streets or highways. Private streets, roads or rights of way shall not be classed as public streets or highways.

DIVISION VII.

LP-GAS SYSTEM INSTALLATIONS ON COMMERCIAL VEHICLES AND CERTAIN SELF-PROPELLED OR TRAILER TYPE MOBILE LIVING UNITS

Division VII applies to LP-Gas system installations on vehicles (whether self-propelled or of the trailer or semi-trailer type) used for commercial, construction or public service purposes such as mobile libraries and clinics; to all exchangeable container systems with container capacities greater than 105 pounds water capacity (approximately 45 pounds LP-Gas capacity) and to systems using containers permanently mounted on vehicles. It does not apply to:

- (a) Travel trailers, mobile units or mobile homes covered by Division VI.
- (b) LP-Gas motor fuel systems covered by Division IV.
- (c) Tank trucks and similar units designed to transport LP-Gas as cargo covered by Division III.

All Basic Rules apply to Division VII unless otherwise noted. When such a vehicle is permanently parked, and LP-Gas is supplied from a system not mounted on and secured to the unit, Division I or II shall apply.

7.1. Construction and Marking of Containers

Containers shall be constructed in accordance with B.3, and marked in accordance with the applicable requirements of B.5, and shall also meet the following:

(a) Containers designed for use as portable cylinders shall be constructed in accordance with ICC specifications,* and as covered by B.3(c).

(b) All other containers whether designed for permanent mounting, or for portable or semi-portable use (such as skid tanks), shall be constructed as provided for by B.3(a) and (b). Mounting, securing and protection of such containers shall be as follows:

1. Permanently installed containers shall meet the requirements of 3.2(a) and (d) inclusive with regard to container valves and accessories, and 3.7 as to mounting.

2. Portable or semi-portable containers (skid tanks as covered by 2.6(g)) shall meet the applicable requirements of 3.2(a) to (f) inclusive with regard to container valves and accessories and

*See I.1.(e).

4.3(c) as to mounting. Containers designed for permanent installation as part of Division II systems shall not be used.

7.2. Capacity of Division VII System

(a) No single fuel container used on passenger carrying vehicles shall exceed 200 gallons water capacity.

7.3. Description of a Division VII System

(a) A Division VII system consists of an assembly of equipment as defined by Item 4 under "Definitions."

7.4. Location of Containers and Systems

(a) Containers shall not be installed, transported, or stored (even temporarily), inside any vehicle covered by this Division except as provided by the applicable regulations of the Interstate Commerce Commission* or the authority having jurisdiction.

(b) Containers, control valves and regulating equipment comprising a complete system shall be suitably protected against damage and weather. Systems may be installed in a recess vaportight to the inside of the vehicle and accessible from and vented to the outside.

(c) Systems installed outside of mobile unit shall be so located that discharge from safety relief devices shall be not less than 3 feet horizontally away from any opening into the unit below the level of such discharge. When system is located in a recess vaportight to the inside (see 7.4b above), vent openings in such recess shall be not less than 3 feet horizontally away from any opening into mobile unit below the level of these vents.

(d) There shall be no fuel connection between tractor and trailer or other vehicle units.

(e) Container or container carrier shall be secured in place by fastenings designed and constructed with a minimum safety factor of four to withstand loading in any direction equal to twice the weight of the container when filled to normal capacity with LP-Gas. (See 4.3(c)).

7.5. Container Valves and Accessories (See B.7(h))

Container valves and accessories shall be provided, protected and mounted as follows:

(a) Systems utilizing ICC* cylinders in accordance with 1.5.

*See I.1.(e).

(b) All other systems in accordance with 2.2(b) through (g).

(c) Portable, semi-portable and permanently mounted containers shall be mounted and protected as provided under 7.1(b).

7.6. Safety Relief Devices

(a) ICC* containers shall be provided with safety relief devices as required by the Regulations of the Interstate Commerce Commission.*

(b) Containers constructed in accordance with the rules of the ASME or the API-ASME shall be provided with safety relief devices as required by B.10.

(c) A final stage regulator of an LP-Gas system (excluding any appliance regulator) shall be equipped on the low pressure side with a relief valve which is set to start to discharge within the limits specified in Table 5 in Division I.

The relief valve and space above the regulator and relief valve diaphragms shall be vented to the outside air and terminate at a position to minimize the possibility of vapors accumulating at sources of ignition.

(d) Whenever equipment such as a cargo heater or cooler on commercial vehicles is a type designed to be in operation while in transit, suitable means to stop the flow, such as an excess flow valve or other device, shall be installed. This device will be actuated to stop the flow in the event of a break in fuel supply line. All excess flow valves shall comply with B.7(c).

7.7. System Design and Line Pressure

Systems may be of either vapor withdrawal or liquid withdrawal type and shall comply with the applicable requirements for the type of usage involved.

7.8. System Enclosure and Mounting

(a) Housing or enclosures shall be designed to provide proper ventilation.

(b) Hoods, domes, or removable portions of cabinets shall be provided with means to keep them firmly in place during transit.

(c) Provision shall be incorporated in the assembly to hold the containers firmly in position and prevent their movement during transit in accordance with 4.3(c).

*See I.1.(e).

(d) Containers shall be mounted on a substantial support or base secured firmly to the vehicle chassis. Neither the container nor its support shall extend below the frame.

7.9. Piping — including Pipe, Tubing and Fittings

(a) Regulators shall be connected directly to the container valve outlet or mounted securely by means of a support bracket and connected to the container valve or valves with a listed high pressure flexible connector.

(b) Provision shall be made between the regulator outlet and the gas service lines by either a flexible connector or a tubing loop to provide for expansion, contraction, jarring and vibration.

(c) Pipe, tubing and fittings shall conform to B.8 except that the use of aluminum alloy piping is prohibited. Steel tubing shall have a minimum wall thickness of 0.049 inches. Steel pipe or tubing shall be adequately protected against exterior corrosion.

(d) Approved gas tubing fittings shall be employed for making tubing connections.

(e) The fuel line shall be firmly fastened in a protected location and where under the vehicle and outside and below any insulation or false bottom, fastenings shall be such as to prevent abrasion or damage to gas line due to vibration. Where the fuel line passes through structural members or floors, a rubber grommet or equivalent shall be installed to prevent chafing.

(f) The fuel line shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance which it serves. When a branch line is required the tee connection shall be in the main fuel line and located under the floor and outside the vehicle.

(g) All parts of the system assembly shall be so designed and secured as to preclude such parts working loose during transit.

7.10. Appliances

(a) LP-Gas appliances shall be approved for use on commercial vehicles.

(b) In the case of vehicles not intended for human occupancy and where the gas-fired heating appliance is used to protect the cargo, such heater may be of the unvented type but provision shall be made to dispose of the products of combustion to the outside.

LP-GAS ON COMMERCIAL VEHICLES

(c) In the case of vehicles intended for human occupancy, all gas-fired heating appliances, including water heaters, shall be designed or installed to provide for complete separation of the combustion system from the atmosphere of the living space. Such appliances shall be installed with the combustion air inlet assembly furnished as a component of the appliance and, also, with either (1) the flue gas outlet assembly furnished as a component of the appliance, or (2) a listed roof jack if the appliance is listed for such use.

The combustion air inlet assembly, flue gas outlet assembly, and roof jack shall extend to the outside atmosphere.

(d) Provision shall be made to insure an adequate supply of outside air for combustion.

(e) All gas-fired heating appliances and water heaters shall be equipped with an approved automatic device designed to shut off the flow of gas to the main burner and to the pilot in the event the pilot flame is extinguished.

(f) Gas-fired appliances installed in the cargo space shall be located so they are readily accessible.

(g) Appliances shall be constructed or protected to reduce to a minimum possible damage or impaired operation resulting from cargo shifting or handling.

(h) Appliances inside the vehicle shall be located so that a fire at an appliance will not block egress of persons therefrom.

7.11. General Precautions

(a) ICC* containers shall be marked, maintained and requalified for use in accordance with the currently effective regulations of the Interstate Commerce Commission.*

(b) Requalification of containers for continued service is the responsibility of the owner; containers shall be stamped with the date of requalification. When ICC* cylinders are requalified by retesting, such retests shall be made in accordance with ICC Regulations.*

(c) Containers shall not be charged with fuel unless they bear the proper markings of the code or specification under which they were constructed, and in addition with their water capacity. In the case of cylinders or portable containers filled by weight, the container shall be marked with its tareweight.

*See I.1.(e).

(d) ICC* containers which have been involved in a fire shall not be recharged until they have been requalified for service according to ICC regulations.

(e) ASME or API-ASME containers which have been involved in a fire shall not be recharged until they have been retested in accordance with the requirements for their original hydrostatic test and found to be suitable for continued service.

(f) Containers shall not be charged without the consent of the owner.

(g) A permanent caution plate shall be provided on the appliance or adjacent to the container outside of any enclosure. It shall include the following items:

Caution

1. Be sure all appliance valves are closed before opening container valve.
2. Connections at the appliances, regulators and containers shall be checked periodically for leaks with soapy water or its equivalent.
3. Never use a match or flame to check for leaks.
4. Container valves shall be closed when the equipment is not in use.

7.12. Charging of Containers

Containers shall be charged as provided in B.12.

7.13. Fire Extinguisher

Mobile cooking units shall be provided with at least one approved portable fire extinguisher having a minimum rating of 8-B,C. Ratings shall be in accordance with the Standard for Installation of Portable Fire Extinguishers, NFPA No. 10.

*See I.1.(e).

DIVISION VIII. LIQUEFIED PETROLEUM GAS SERVICE STATIONS

Division VIII applies to storage containers, and dispensing devices, and pertinent equipment in service stations where LP-Gas is stored and is dispensed into fuel tanks of motor vehicles. (See Division IV for requirements covering use of LP-Gas as a motor fuel.) All Basic Rules apply to this division unless otherwise noted. Containers and pertinent equipment shall comply with the requirements as outlined herein as well as with the requirements of the state or local authority having jurisdiction where the service stations will be constructed.

8.1. Design Pressure and Classification of Storage Containers

Storage containers shall be designed and classified in accordance with Table 10.

Table 10

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gage at 100 F. (37.8 C.)	1949 and earlier editions of ASME Code (Par. U-68, U-69)	Minimum Design Pressure of Container lb. per sq. in. gage 1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, and 1965 editions of ASME Code; All editions of API-ASME Code**
200*	215	200	250

*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, 1959, 1962, and 1965 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, 1961.

8.2. Container Valves and Accessories. [See B.7(h).]

(a) A filling connection on the container shall be fitted with one of the following:

1. A combination back-pressure check and excess flow valve
2. One double or two single back-pressure valves
3. A positive shutoff valve, in conjunction with either:
 - (a) An internal back-pressure valve, or

(b) An internal excess flow valve.

NOTE: In lieu of an excess flow valve, filling connections may be fitted with a quick-closing internal valve, which shall remain closed except during operating periods. The mechanism for such valves may be provided with a secondary control which will cause it to close automatically in case of fire. When a fusible plug is used its melting point shall not exceed 220 F.

(b) A filling pipe inlet terminal not on the container shall be fitted with a positive shutoff valve in conjunction with either (1) a back pressure check valve, or (2) an excess flow check valve.

(c) All openings in the container except those listed below shall be equipped with approved excess flow check valves:

1. Filling connections as provided in 8.2(a)
2. Safety relief connections as provided in B.7(b)
3. Liquid level gaging devices as provided in B.7(d), B.19(d), and (i)
4. Pressure gage connections as provided in B.7(e)

(d) All container inlets and outlets except those listed below shall be labeled to designate whether they connect with the vapor or liquid (labels may be on valves):

1. Safety relief valves
2. Liquid level gaging devices
3. Pressure gages

(e) Each storage container shall be provided with a suitable pressure gage.

8.3. Safety Relief Valves

(a) All safety relief devices shall be installed as follows:

1. On the container and directly connected with the vapor space.

2. Safety relief valves and discharge piping shall be protected against physical damage. The outlet shall be provided with loose-fitting raincaps. There shall be no return bends or restrictions in the discharge piping.

3. The discharge from two or more safety relief valves having the same pressure settings may be run into a common discharge header. The cross-sectional area of such header shall be at least equal to the sum of the cross-sectional area of the individual discharges.

4. Discharge from any safety relief device shall not terminate in any building nor beneath any building.

(b) Aboveground containers shall be provided with safety relief valves as follows:

1. The rate of discharge, which may be provided by one or more valves, shall be not less than that specified in Appendix A.

2. The discharge from safety relief valves shall be vented to the open air unobstructed and vertically upwards in such a manner as to prevent any impingement of escaping gas upon the container; loose fitting raincaps shall be used. On a container having a water capacity greater than 2,000 gallons, the discharge from the safety relief valves shall be vented away from the container vertically upwards to a point at least 7 feet above the container. Suitable provisions shall be made so that any liquid or condensate that may accumulate inside of the relief valve or its discharge pipe will not render the valve inoperative. If a drain is used, a means shall be provided to protect the container, adjacent containers, piping or equipment against impingement of flame resulting from ignition of product escaping from the drain [see B.10 (i)].

(c) Underground containers shall be provided with safety relief valves as follows:

1. The discharge from safety relief valves shall be piped vertically upward to a point at least 10 feet above the ground. The discharge lines or pipes shall be adequately supported and protected against physical damage.

2. Where there is a probability of the manhole or housing becoming flooded, the discharge from regulator vent lines should be above the highest probable water level.

3. If no liquid is put into a container until after it is buried and covered, the rate of discharge of the relief valves may be reduced to not less than 30 per cent of the rate shown in Appendix A. If liquid fuel is present during installation of containers, the rate of discharge shall be the same as for aboveground containers. Such containers shall not be uncovered until emptied of liquid fuel.

8.4. Capacity of Liquid Containers

Individual liquid storage containers shall not exceed 30,000 gallons water capacity.

8.5. Installation of Storage Containers

(a) General

1. Each storage container used exclusively in service station operation shall comply with the following table which specifies

minimum distances to a building, groups of buildings and adjoining property lines which may be built upon:

<i>Water Capacity per Container</i>	<i>Minimum Distances</i>	
	<i>Aboveground and Underground</i>	<i>Between Aboveground Containers</i>
Up to 2,000 gallons	25 feet	3 feet
Over 2,000 gallons	50 feet	5 feet

NOTE: The above distances may be reduced to not less than 10 feet for service station buildings of other than wood frame construction.

2. In heavily populated or congested areas, the authority having jurisdiction shall determine restrictions of individual tank capacity, total storage, and distance to line of adjoining property which may be built on and other reasonable protective methods.

3. Readily ignitable material including weeds and long dry grass, shall be removed within 10 feet of containers.

4. The minimum separation between LP-Gas containers and flammable liquid tanks shall be 20 feet and the minimum separation between a container and the center line of the dike shall be 10 feet.

5. LP-Gas containers located near flammable liquid containers shall be protected against the flow or accumulation of flammable liquids by diking, diversion curbs, or grading.

6. LP-Gas containers shall not be located within diked areas for flammable liquid containers.

7. Field welding is permitted only on saddle plates or brackets which were applied by the container manufacturer.

8. When permanently installed containers are interconnected, provision shall be made to compensate for expansion, contraction, vibration and settling of containers and interconnecting piping. Where flexible connections are used, they shall be of an approved type and shall be designed for a bursting pressure of not less than five times the vapor pressure of the product at 100 F. The use of nonmetallic hose is prohibited for interconnecting such containers.

9. Where high water table or flood conditions may be encountered protection against container flotation shall be provided.

(b) Aboveground Containers

1. Containers may be installed horizontally or vertically.

2. Containers shall be protected by crash rails or guards to prevent physical damage unless they are so protected by virtue of their location. Vehicles shall not be serviced within 10 feet of containers.

3. Container foundations shall be of substantial masonry or other noncombustible material. Containers shall be mounted on saddles which shall permit expansion and contraction, and shall provide against the excessive concentration of stresses. Corrosion protection shall be provided for tank mounting areas. Structural metal container supports shall be protected against fire in an approved manner. This protection is not required on prefabricated storage and pump assemblies, mounted on a common base, with container bottom not more than 24 inches aboveground and whose water capacity is 2,000 gallons or less if the piping connected to the storage and pump assembly is sufficiently flexible to minimize the possibility of breakage or leakage in the event of failure of the container supports (2.6(g)3 does not apply).

(c) Underground containers

1. Containers shall be given a protective coating before being placed underground. This coating shall be equivalent to hot dip galvanizing or to two coatings of red lead followed by a heavy coating of coal tar or asphalt. In lowering the container into place, care shall be exercised to minimize abrasion or other damage to the coating. Damage to the coating shall be repaired before backfilling.

2. Containers shall be set on a firm foundation (firm earth may be used) and surrounded with earth or sand firmly tamped in place. Backfill should be free of rocks or other abrasive materials.

3. A minimum of 2 feet of earth cover should be provided. Where ground conditions make compliance with this requirement impractical, equivalent protection against physical damage shall be provided. The portion of the container to which manhole and other connections are attached need not be covered. If the location is subjected to vehicular traffic, containers shall be protected by a concrete slab or other cover adequate to prevent the weight of a loaded vehicle imposing concentrated direct loads on the container shell.

8.6. Protection of Container Fittings

(a) Valves, regulators, gages, and other container fittings shall be protected against tampering and physical damage.

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

8.7. Transport Truck Unloading Point

(a) During unloading, the transport truck shall not be parked on public thoroughfares (see B.15) and shall be at least 5 feet from

storage containers, and shall be positioned so that shutoff valves are readily accessible.

(b) The filling pipe inlet terminal shall not be located within a building nor within 10 feet of any building or driveway. It shall be protected against physical damage.

8.8. Piping, Valves and Fittings

(a) Piping may be underground, aboveground, or a combination of both. It shall be well supported and protected against physical damage and corrosion.

(b) Piping laid beneath driveways shall be installed to prevent physical damage by vehicles.

(c) Piping shall be wrought iron or steel (black or galvanized), brass or copper pipe; or seamless copper, brass or steel tubing and shall be suitable for a minimum pressure of 250 psig [see B.8(a)]. Pipe joints may be screwed, flanged, brazed or welded. The use of aluminum alloy piping or tubing is prohibited.

(d) All shutoff valves (liquid or gas) shall be suitable for liquefied petroleum gas service and designed for not less than the maximum pressure to which they may be subjected. Valves which may be subjected to container pressure shall have a rated working pressure of at least 250 psig.

(e) All materials used for valve seats, packing, gaskets, diaphragms, etc., shall be resistant to the action of LP-Gas.

(f) Fittings shall be steel, malleable iron or brass having a minimum working pressure of 250 psig. Cast iron pipe fittings, such as ells, tees, and unions shall not be used.

(g) All piping shall be tested after assembly and proved free from leaks at not less than normal operating pressures.

(h) Provision shall be made for expansion, contraction, jarring and vibration, and for settling. This may be accomplished by flexible connections.

8.9. Pumps and Accessories

All pumps and accessory equipment shall be suitable for LP-Gas service, and designed for not less than the maximum pressure to which they may be subjected. Accessories shall have a minimum rated working pressure of 250 psig. Positive displacement pumps shall be equipped with suitable pressure actuated by-pass valves permitting flow from pump discharge to storage container or pump suction.

8.10. Dispensing Devices

(a) Meters, vapor separators, valves, and fittings in the dispenser shall be suitable for LP-Gas service and shall be designed for a minimum working pressure of 250 psig.

(b) Provisions shall be made for venting LP-Gas contained in a dispensing device to a safe location.

NOTE: One way of accomplishing this is to vent the LP-Gas at the point of discharge of the storage tank safety relief valve.

(c) Pumps used to transfer LP-Gas shall be equipped to allow control of the flow and to prevent leakage or accidental discharge. Means shall be provided outside the dispensing device to readily shut off the power in the event of fire or accident.

(d) A manual shutoff valve and an excess flow check valve shall be installed downstream of the pump and ahead of the dispenser inlet.

(e) Dispensing Hose.

1. Hose shall be resistant to the action of LP-Gas in the liquid phase and designed for a minimum bursting pressure of 1,250 psig.

2. An excess flow check valve or automatic shutoff valve shall be installed at the terminus of the liquid line at the point of attachment of the dispensing hose.

(f) Location.

1. LP-Gas dispensing devices shall be located not less than 10 feet from aboveground storage containers greater than 2,000 gallons water capacity. The dispensing devices shall not be less than 20 feet from any building (not including canopies), basement, cellar, pit or line of adjoining property which may be built upon and not less than 10 feet from sidewalks, streets, or thoroughfares. No drains or blow-off lines shall be directed into or in proximity to the sewer systems used for other purposes.

2. LP-Gas dispensing devices shall be installed on a concrete foundation or as part of a complete storage and dispensing assembly mounted on a common base, and shall be adequately protected from physical damage.

3. LP-Gas dispensing devices shall not be installed within a building except that they may be located under a weather shelter or canopy provided this area is not enclosed on more than two sides. If the enclosing sides are adjacent to each other, the area shall be properly ventilated.

(g) The dispensing of LP-Gas into the fuel container of a vehicle shall be performed by a competent attendant who shall remain at the LP-Gas dispenser during the entire transfer operation.

8.11. Safety Rules

There shall be no smoking on the driveway of service stations in the dispensing areas or transport truck unloading areas. Conspicuous signs prohibiting smoking shall be posted within sight of the customer being served. Letters on such signs shall be not less than 4 inches high. The motors of all vehicles being fueled shall be shut off during the fueling operations.

8.12. Electrical

Electrical equipment and installations shall conform to B.17 and B.18.

8.13. Fire Protection

Each service station shall be provided with at least one portable fire extinguisher having at least an 8-B, C, rating. Ratings shall be in accordance with the Standard for Installation of Portable Fire Extinguishers, NFPA No. 10.

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 valves to be used on containers other than those constructed in accordance with Interstate Commerce Commission* specification

<i>Surface Area</i> <i>Sq. Ft.</i>	<i>Flow Rate</i> <i>CFM</i> <i>Air</i>	<i>Surface Area</i> <i>Sq. Ft.</i>	<i>Flow Rate</i> <i>CFM</i> <i>Air</i>	<i>Surface Area</i> <i>Sq. Ft.</i>	<i>Flow Rate</i> <i>CFM</i> <i>Air</i>
20 or less	626	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 nameplate or when

*See I.1.(e).

the marking is not legible, the area can be calculated by using one of the following formulas:

- (1) Cylindrical container with hemispherical heads
Area = Over-all length \times outside diameter \times 3.1416
- (2) Cylindrical container with other than hemispherical heads
Area = (Over-all length + 0.3 outside diameter) \times outside diameter \times 3.1416

NOTE: This formula is not exact, but will give results within the limits of practical accuracy for the sole purpose of sizing relief valves.

- (3) Spherical container
Area = Outside diameter squared \times 3.1416

Flow Rate-CFM Air = Required flow capacity in cubic feet per minute of air at standard conditions, 60 F. and atmospheric pressure (14.7 psia).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than 2,000 square feet, the required flow rate can be calculated using the formula, Flow Rate-CFM Air = 53.632 A^{0.82}.

A = total outside surface area of the container in square feet.

Valves not marked "Air" have flow rate marking in cubic feet per minute of liquefied petroleum gas. These can be converted to ratings in cubic feet per minute of air by multiplying the liquefied petroleum gas ratings by the factors listed below. Air flow ratings can be converted to ratings in cubic feet per minute of liquefied petroleum gas by dividing the air ratings by the factors listed below.

Air Conversion Factors

Container Type	100	125	150	175	200
Air Conversion Factor	1.162	1.142	1.113	1.078	1.010

APPENDIX B.

Minimum Required Rate of Discharge for Safety Relief Valves for Liquefied Petroleum Gas Vaporizers (Steam Heated, Water Heated and Direct Fired)

The minimum required rate of discharge for safety relief valves shall be determined as follows:

1. Obtain the total surface area by adding the surface area of vaporizer shell in square feet directly in contact with LP-Gas and the heat exchange surface area in square feet directly in contact with LP-Gas.
2. Obtain the minimum required rate of discharge in cubic feet of air per minute, at 60 F. and 14.7 psia from Appendix A for this total surface area.

APPENDIX C.

Method of Calculating Maximum Liquid Volume Which Can Be Placed in a Container at Any Liquid Temperature

The quantity of gas which may be placed in a container is dependent upon the temperature of the liquid in the container and the maximum permitted filling density in addition to the size of the container.

The filling density depends on: The size of the container, whether it is installed aboveground or underground and the specific gravity at 60 F. of the LP-gas placed in the container. Filling density values for these conditions are given in Section B.12. Since the temperature of the liquid in the container is seldom exactly 60 F., it is necessary to measure the actual liquid temperature and then obtain a correction factor from the attached Table and insert this in the following formula. The average liquid temperature may be obtained by one of two ways. One procedure is to measure the liquid temperature in the container after the container is almost filled to its permissible liquid content. This is secured by inserting a thermometer into a thermometer well installed in the container so as to be in the liquid. The other procedure can only be used if the container is essentially empty prior to filling. In this case, the liquid temperature is measured by a thermometer placed in a thermometer well or other device installed in the filling line at a place near the container. The temperature should be read at intervals and averaged.

Knowing the filling density, the liquid specific gravity at 60 F. of the product to be placed in the container, the correction factor for the temperature of the liquid in the container, and the container capacity, the maximum quantity that can be placed in a container is determined as follows:

$$V = \frac{D}{G \times F}$$

Where

V = Maximum liquid volume (in per cent of total container capacity) which shall be placed in a container when the liquid temperature is T.

D = filling density from B.12(a) in per cent.

G = specific gravity of LP-Gas at 60 F. placed in container.

F = correction factor from following table for correcting liquid volume from 60 F. to volume at temperature T. The correction factor is obtained by finding the specific gravity at 60 F. (G) in the column at the top of the table and coming down this column till the actual liquid temperature T is found. The correction factor corresponding to this specific gravity and temperature is then read. Interpolation is permitted.

T = temperature of liquid LP-Gas in container in degrees Fahrenheit.

After obtaining V from the above formula the actual maximum gallons, Q_T , of LP-Gas which may be placed in a container is obtained by multiplying the water capacity of the container by $\frac{V}{100}$

Where

Q_T = actual gallons at liquid temperature, T.

Example:

Assume an aboveground container with 10,000 gallons water capacity

Propane with a specific gravity of 0.508 at 60 F. to be placed in container

Filling density from B.12(a) for aboveground container having a capacity greater than 1,200 gallons in which a product having a specific gravity at 60 F. of 0.508 is to be placed is 45%

LIQUID VOLUME CORRECTION FACTORS

SPECIFIC GRAVITIES AT 60° F./60° F.

Observed Temperature Degree Fahrenheit	0.500	Propane 0.5079	0.510	0.520	0.530	0.540	0.550	0.560	iso-Butane 0.5631	0.570	0.580	n-Butane 0.5844	0.590
	VOLUME CORRECTION FACTORS												
-50.....	1.160	1.155	1.153	1.146	1.140	1.133	1.127	1.122	1.120	1.116	1.111	1.108	1.106
-45.....	1.163	1.148	1.146	1.140	1.134	1.128	1.122	1.117	1.115	1.111	1.106	1.103	1.101
-40.....	1.147	1.142	1.140	1.134	1.128	1.122	1.117	1.111	1.110	1.106	1.101	1.099	1.097
-35.....	1.140	1.135	1.134	1.128	1.122	1.116	1.112	1.106	1.105	1.101	1.096	1.094	1.092
-30.....	1.134	1.129	1.128	1.122	1.116	1.111	1.106	1.101	1.100	1.096	1.092	1.090	1.088
-25.....	1.127	1.122	1.121	1.115	1.110	1.105	1.100	1.095	1.094	1.091	1.087	1.085	1.083
-20.....	1.120	1.115	1.114	1.109	1.104	1.099	1.093	1.090	1.089	1.086	1.082	1.080	1.079
-15.....	1.112	1.109	1.107	1.102	1.097	1.093	1.089	1.084	1.083	1.080	1.077	1.075	1.074
-10.....	1.106	1.102	1.100	1.095	1.091	1.087	1.083	1.079	1.078	1.075	1.072	1.071	1.069
-5.....	1.098	1.094	1.094	1.089	1.085	1.081	1.077	1.074	1.073	1.070	1.067	1.066	1.065
0.....	1.092	1.088	1.088	1.084	1.080	1.076	1.073	1.069	1.068	1.065	1.063	1.062	1.061
2.....	1.089	1.086	1.085	1.081	1.077	1.074	1.070	1.067	1.066	1.064	1.061	1.060	1.059
4.....	1.086	1.083	1.082	1.079	1.075	1.071	1.068	1.065	1.064	1.062	1.059	1.058	1.057
6.....	1.084	1.080	1.080	1.076	1.072	1.069	1.065	1.062	1.061	1.059	1.057	1.055	1.054
8.....	1.081	1.078	1.077	1.074	1.070	1.066	1.063	1.060	1.059	1.057	1.055	1.053	1.052
10.....	1.078	1.075	1.074	1.071	1.067	1.064	1.061	1.058	1.057	1.055	1.053	1.051	1.050
12.....	1.075	1.072	1.071	1.068	1.064	1.061	1.059	1.056	1.055	1.053	1.051	1.049	1.048
14.....	1.072	1.070	1.069	1.066	1.062	1.059	1.056	1.053	1.053	1.051	1.049	1.047	1.046
16.....	1.070	1.067	1.066	1.063	1.060	1.056	1.054	1.051	1.050	1.048	1.046	1.045	1.044
18.....	1.067	1.065	1.064	1.061	1.057	1.054	1.051	1.049	1.048	1.046	1.044	1.043	1.042
20.....	1.064	1.062	1.061	1.058	1.054	1.051	1.049	1.046	1.046	1.044	1.042	1.041	1.040
22.....	1.061	1.059	1.058	1.055	1.052	1.049	1.046	1.044	1.044	1.042	1.040	1.038	1.037
24.....	1.058	1.056	1.055	1.052	1.049	1.046	1.044	1.042	1.042	1.040	1.038	1.037	1.036
26.....	1.055	1.053	1.052	1.049	1.047	1.044	1.042	1.039	1.039	1.037	1.036	1.034	1.034
28.....	1.052	1.050	1.049	1.047	1.044	1.041	1.039	1.037	1.037	1.035	1.034	1.032	1.032
30.....	1.049	1.047	1.046	1.044	1.041	1.039	1.037	1.035	1.035	1.033	1.032	1.032	1.030
32.....	1.046	1.044	1.043	1.041	1.038	1.036	1.035	1.033	1.033	1.031	1.030	1.030	1.028
34.....	1.043	1.041	1.040	1.038	1.036	1.034	1.032	1.031	1.030	1.029	1.028	1.028	1.026
36.....	1.039	1.038	1.037	1.035	1.033	1.031	1.030	1.028	1.028	1.027	1.025	1.025	1.024
38.....	1.036	1.035	1.034	1.032	1.031	1.029	1.027	1.026	1.025	1.025	1.023	1.023	1.022
40.....	1.033	1.032	1.031	1.029	1.028	1.026	1.025	1.024	1.023	1.023	1.021	1.021	1.020
42.....	1.030	1.029	1.028	1.027	1.025	1.024	1.023	1.022	1.021	1.021	1.019	1.019	1.018
44.....	1.027	1.026	1.025	1.023	1.022	1.021	1.020	1.019	1.019	1.018	1.017	1.017	1.016
46.....	1.024	1.023	1.022	1.021	1.020	1.018	1.018	1.017	1.017	1.016	1.015	1.015	1.014
48.....	1.020	1.019	1.019	1.018	1.017	1.016	1.015	1.014	1.014	1.013	1.013	1.013	1.012
50.....	1.017	1.016	1.016	1.015	1.014	1.013	1.013	1.012	1.012	1.011	1.011	1.011	1.010
52.....	1.014	1.013	1.013	1.012	1.011	1.010	1.010	1.009	1.009	1.009	1.009	1.009	1.008
54.....	1.010	1.010	1.009	1.009	1.008	1.008	1.007	1.007	1.007	1.007	1.006	1.006	1.006
56.....	1.007	1.007	1.006	1.006	1.005	1.005	1.005	1.005	1.005	1.005	1.004	1.004	1.004
58.....	1.003	1.003	1.003	1.003	1.003	1.003	1.002	1.002	1.002	1.002	1.002	1.002	1.002
60.....	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
62.....	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998	0.998	0.998	0.998	0.998
64.....	0.993	0.993	0.994	0.994	0.994	0.994	0.995	0.995	0.995	0.995	0.995	0.996	0.996
66.....	0.990	0.990	0.990	0.990	0.991	0.992	0.992	0.993	0.993	0.993	0.993	0.993	0.993
68.....	0.989	0.988	0.987	0.987	0.988	0.989	0.990	0.990	0.990	0.990	0.991	0.991	0.991
70.....	0.983	0.983	0.984	0.984	0.985	0.986	0.987	0.988	0.988	0.988	0.989	0.989	0.989
72.....	0.979	0.980	0.981	0.981	0.982	0.983	0.984	0.985	0.986	0.986	0.987	0.987	0.987
74.....	0.976	0.976	0.977	0.978	0.980	0.980	0.982	0.983	0.983	0.984	0.985	0.985	0.985
76.....	0.972	0.973	0.974	0.975	0.977	0.978	0.979	0.980	0.981	0.981	0.982	0.982	0.983
78.....	0.969	0.970	0.970	0.972	0.974	0.975	0.977	0.978	0.978	0.979	0.980	0.980	0.981
80.....	0.965	0.967	0.967	0.969	0.971	0.972	0.974	0.975	0.976	0.977	0.978	0.978	0.979
82.....	0.961	0.963	0.963	0.966	0.968	0.969	0.971	0.972	0.973	0.974	0.976	0.976	0.977
84.....	0.957	0.959	0.960	0.962	0.965	0.966	0.968	0.970	0.971	0.972	0.974	0.974	0.975
86.....	0.954	0.956	0.956	0.959	0.961	0.964	0.966	0.967	0.968	0.969	0.971	0.971	0.972
88.....	0.950	0.952	0.953	0.955	0.958	0.961	0.963	0.965	0.966	0.967	0.969	0.969	0.970
90.....	0.946	0.949	0.949	0.952	0.955	0.958	0.960	0.962	0.963	0.964	0.967	0.967	0.968
92.....	0.942	0.946	0.946	0.949	0.952	0.955	0.957	0.959	0.960	0.961	0.964	0.964	0.965
94.....	0.938	0.941	0.942	0.946	0.949	0.952	0.954	0.957	0.958	0.959	0.962	0.962	0.964
96.....	0.935	0.938	0.939	0.942	0.946	0.949	0.952	0.954	0.955	0.957	0.959	0.960	0.961
98.....	0.931	0.934	0.935	0.939	0.943	0.946	0.949	0.952	0.953	0.954	0.957	0.957	0.959
100.....	0.927	0.930	0.932	0.936	0.940	0.943	0.946	0.949	0.950	0.952	0.954	0.955	0.957
105.....	0.917	0.920	0.923	0.927	0.931	0.935	0.939	0.943	0.943	0.946	0.949	0.949	0.951
110.....	0.907	0.911	0.913	0.918	0.923	0.927	0.932	0.936	0.937	0.939	0.943	0.944	0.946
115.....	0.897	0.902	0.904	0.909	0.915	0.920	0.925	0.930	0.930	0.933	0.937	0.938	0.940
120.....	0.887	0.892	0.894	0.900	0.907	0.912	0.918	0.923	0.924	0.927	0.931	0.932	0.934
125.....	0.876	0.881	0.884	0.890	0.898	0.903	0.909	0.915	0.916	0.920	0.925	0.927	0.928
130.....	0.865	0.871	0.873	0.880	0.888	0.895	0.901	0.908	0.909	0.913	0.918	0.921	0.923
135.....	0.854	0.861	0.863	0.871	0.879	0.887	0.894	0.901	0.902	0.907	0.912	0.914	0.916
140.....	0.842	0.850	0.852	0.861	0.870	0.879	0.886	0.893	0.895	0.900	0.905	0.907	0.910

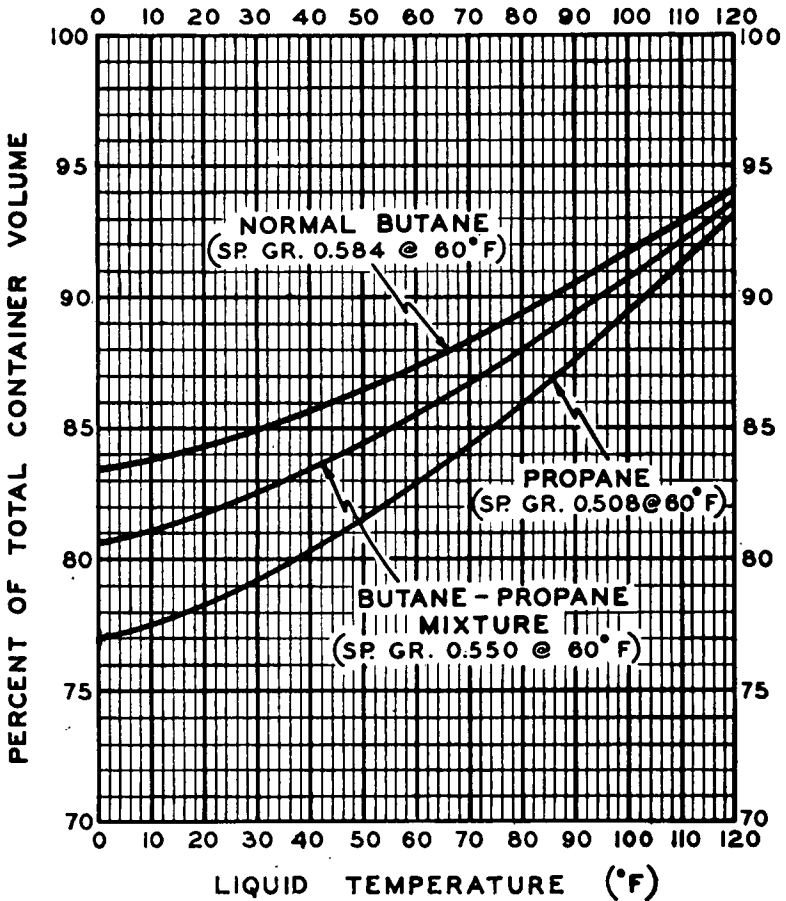


Figure C-1

Maximum Filling Level for Aboveground Containers
(0-1200 Gallons Water Capacity)

NOTE: This graph applies solely to the product having
the specific gravity shown.

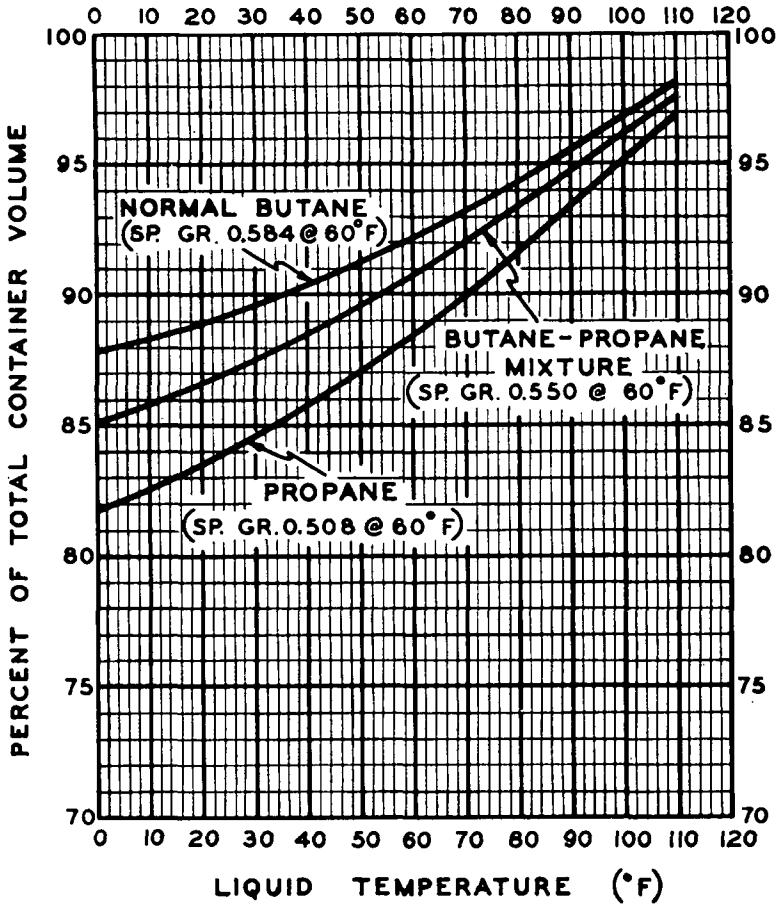


Figure C-2
Maximum Filling Level for Aboveground Containers
(Over 1200 Gallons Water Capacity)

NOTE: This graph applies solely to the product having the specific gravity shown.

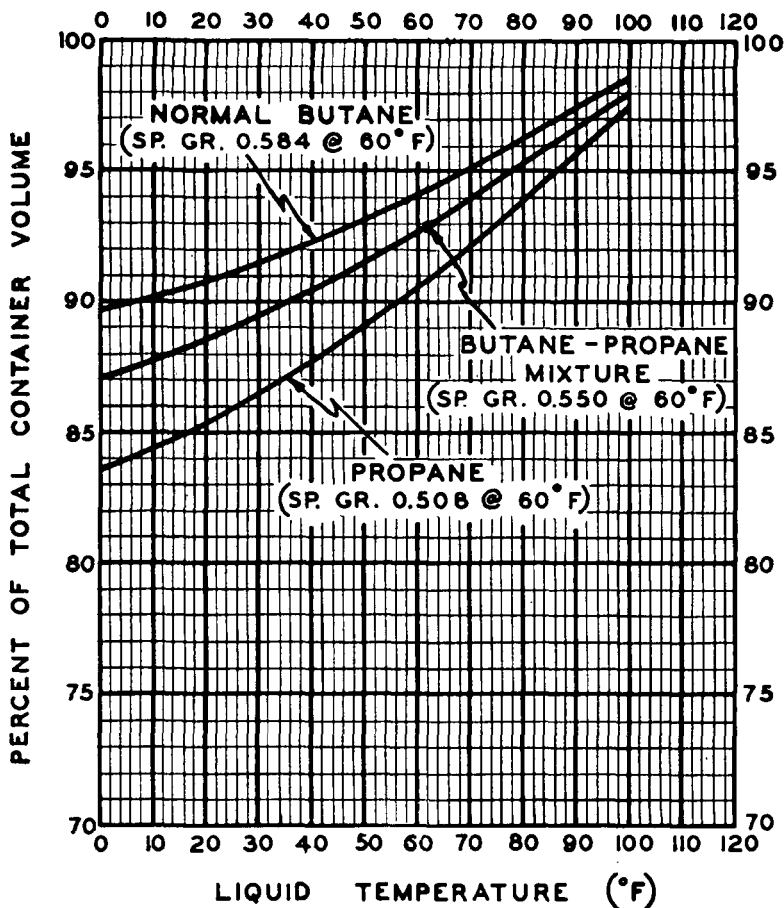


Figure C-3

Maximum Filling Level for Underground Containers

NOTE: This graph applies solely to the product having the specific gravity shown.

To determine maximum quantity that may be placed in container when the liquid temperature is 60 F.

$$Q_{60^{\circ}\text{F}} = \frac{45 \times 10,000}{0.508 \times 100} = 8,860 \text{ gallons}$$

When liquid temperature is 82 F. find correction factor in the table on next page for specific gravity at 60 F. of 0.508 and a liquid temperature of 82 F: which is 0.963.

$$Q_{82^{\circ}\text{F}} = \frac{45 \times 10,000}{0.508 \times 0.963 \times 100} = 9,200 \text{ gallons}$$

APPENDIX D.

Alternate Permitted Maximum Liquid Volumes in Per Cent of Total Container Capacity for Filling Containers up to 1200 Gallons Total Water Capacity as Specified in B.12(c)

MAXIMUM LIQUID VOLUME PER CENT

	<i>Aboveground Containers Liq. Temp. Assumed to be 40 F.</i>	<i>Underground Containers Liq. Temp. Assumed to be 50 F.</i>
Propane (Approx. sp.gr. 0.51)	80	89
Mixtures (Approx. sp.gr. 0.55)	83	91
Butane (Approx. sp.gr. 0.58)	86	93

APPENDIX E.

Method of Calculating Maximum Volume of LP-Gas which can be placed in a container for which length of fixed dip tube is set

1. It is impossible to set out in a table the length of a fixed dip tube for various capacity tanks because of the varying tank diameters and lengths and because the tank may be installed either in a vertical or horizontal position. Knowing the maximum permitted filling volume in gallons, however, the length of the fixed tube can be determined by the use of a strapping table obtained from the container manufacturer. The length of the fixed tube should be such that when its lower end touches the surface of the liquid in the container, the contents of the container will be the maximum permitted volume as determined by the following formula:

2. Formula for determining maximum volume of Liquefied Petroleum Gas for which a fixed length of dip tube shall be set.

$$\frac{\text{Water Cap. (Gals.) of Container}^* \times \text{Filling Density}^{**}}{\text{Sp. Gr. of LP-Gas}^* \times \text{volume Correction Factor}^\dagger \times 100} = \begin{matrix} \text{Maximum} \\ \text{Volume} \\ \text{of} \\ \text{LP-Gas.} \end{matrix}$$

*Measured at 60 F.

**From Section B.12 "Filling Densities."

†For aboveground containers the liquid temperature is assumed to be 40 F. and for underground containers the liquid temperature is assumed to be 50 F. To correct the liquid volumes at these temperatures to 60 F. the following factors shall be used [see Section B.19(e)].

Volume Correction Factors

<i>Specific Gravity</i>	<i>Aboveground</i>	<i>Underground</i>
0.500	1.033	1.017
.510	1.031	1.016
.520	1.029	1.015
.530	1.028	1.014
.540	1.026	1.013
.550	1.025	1.013
.560	1.024	1.012
.570	1.023	1.011
.580	1.021	1.011
.590	1.020	1.010

Example: Assume a 100-gallon total water capacity tank for aboveground storage of propane having a specific gravity of 0.510 at 60 F.

$$\frac{100 \text{ (gals.)} \times 42 \text{ (Filling Density from B.12)}}{0.510 \times 1.031 \text{ (Correction Factor from Table in Appendix E)} \times 100} = \frac{4200}{52.6}$$

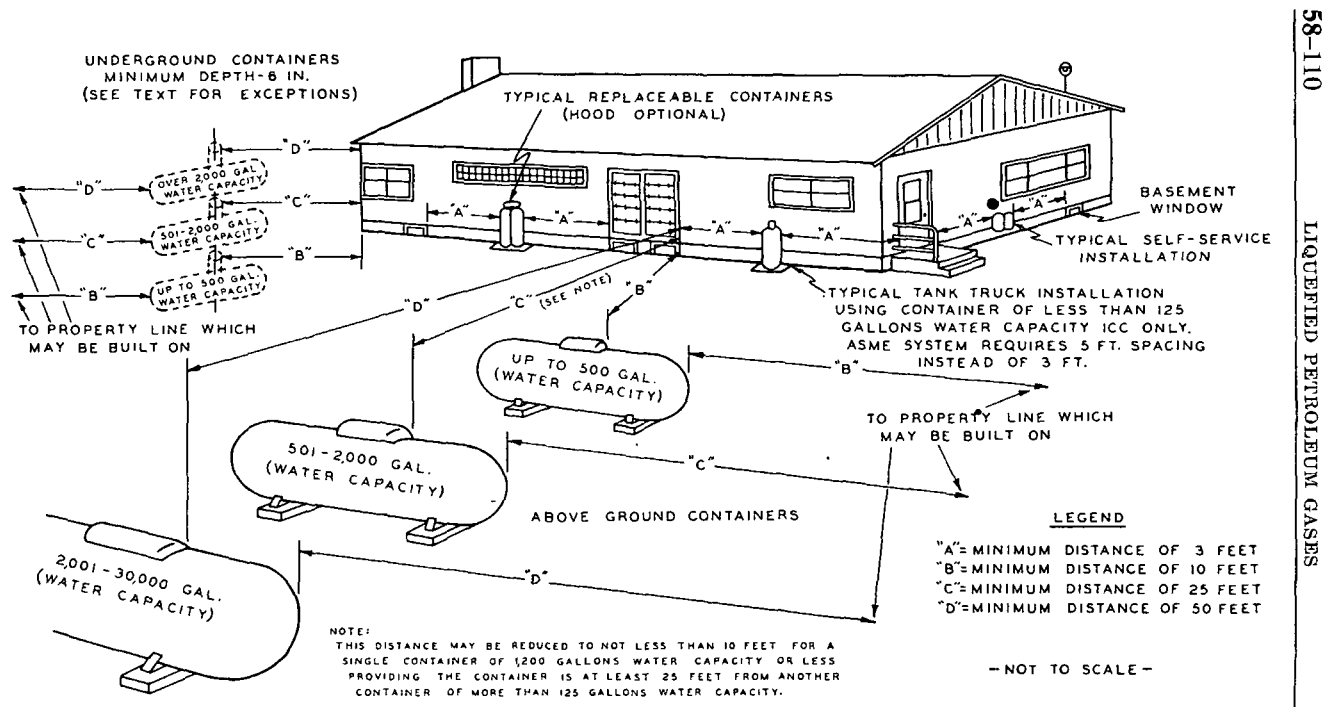
$\frac{4200}{52.6} = 79.8$ gallons propane, the maximum amount permitted to be placed in a 100-gallon total water capacity aboveground container equipped with a fixed dip tube.

3. The maximum volume of LP-Gas which can be placed in a container when determining the length of the dip tube expressed as a percentage of total water content of the container is calculated by the following formula:

$$\frac{\text{Maximum Vol. of LP-Gas (From Formula in (2) above)} \times 100}{\text{Total water content of container in gallons}} = \begin{matrix} \text{Maximum} \\ \text{Per Cent} \\ \text{of} \\ \text{LP-Gas} \end{matrix}$$

4. The maximum weight of LP-Gas which may be placed in a container *for determining the length of a fixed dip tube* is determined by multiplying the maximum volume of liquefied petroleum gas obtained by the formula in (2) above by the pounds of liquefied petroleum gas in a gallon at 40 F. for aboveground and at 50 F. for underground containers. For example typical pounds per gallon are specified below:

	<i>Aboveground pounds per gallon</i>	<i>Underground pounds per gallon</i>
Propane	4.37	4.31
N Butane	4.97	4.92



Appendix F. Container Spacing

58-110

LIQUEFIED PETROLEUM GASES

APPENDIX G.

TABLE G-1

Wall Thickness of Copper Tubing*

NOTE: The standard size by which tube is designated is $\frac{1}{8}$ inch smaller than its nominal outside diameter.

<i>Standard Size</i>	<i>Nominal O.D.</i>	<i>Nominal Wall Thickness</i>	
		<i>Inches</i>	
<i>Inches</i>	<i>Inches</i>	<i>Type K</i>	<i>Type L</i>
$\frac{1}{4}$	0.375	0.035	0.030
$\frac{3}{8}$	0.500	0.049	0.035
$\frac{1}{2}$	0.625	0.049	0.040
$\frac{5}{8}$	0.750	0.049	0.042
$\frac{3}{4}$	0.875	0.065	0.045
1	1.125	0.065	0.050
$1\frac{1}{4}$	1.375	0.065	0.055
$1\frac{1}{2}$	1.625	0.072	0.060
2	2.125	0.083	0.070

*Based on data in USA Standard Specification for Seamless Copper Water Tube, H 23.1 (ASTM B-88).

TABLE G-2

Wall Thickness of Aluminum Alloy Tubing*

<i>Outside Diameter</i>	<i>Nominal Wall Thickness</i>	
	<i>Inches</i>	
<i>Inches</i>	<i>Type A</i>	<i>Type B</i>
$\frac{3}{8}$	0.035	0.049
$\frac{1}{2}$	0.035	0.049
$\frac{5}{8}$	0.042	0.049
$\frac{3}{4}$	0.049	0.058

*Based on data in Standard Specification for Aluminum-Alloy Drawn Seamless Coiled Tubes for Special Purpose Applications, ASTM B-307.

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National Fire Protection Association International

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Interim Amendment to NFPA No. 58

In accordance with Section 100 of the *Regulations Governing Technical Committees*, the Committee on Liquefied Petroleum Gases has released the following Interim Amendment to the 1967 Edition of NFPA No. 58 (USA Standard Z106.1), effective as of April 15, 1968:

1. Delete 1.4(a)8 in its entirety.
2. Renumber 1.4(a)9 as 1.4(a)8 and revise as follows:

1.4(a)8. Portable heaters, including salamanders, shall be equipped with an approved automatic device to shut off the flow of gas to the main burner, and pilot if used, in the event of flame extinguishment. Such heaters having inputs above 50,000 Btuh manufactured on or after May 17, 1967, and such heaters having inputs above 75,000 Btuh manufactured before May 17, 1967, shall be equipped with either (1) a pilot that must be lighted and proved before the main burner can be turned on or (2) an electric ignition system.

The provisions of 1.4(a)8 do not apply to tar kettle burners, torches, or melting pots, nor do they apply to portable heaters under 7,500 Btuh input when used with containers having a maximum water capacity of 2½ pounds.

3. Renumber 1.4(a)10 through 13 as 1.4(a)9 through 12.

The effect of this Interim Amendment is to:

1. Remove a redundancy represented by old 1.4(a)8, inasmuch as that provision is covered by B.20(a) and (b).
2. Provide for a more reasonable and orderly transition period for the provision of light-off safety controls on the smaller portable heaters rated between over 50,000 Btuh and up to and including 75,000 Btuh.

In accordance with NFPA procedures, this Interim Amendment is tentative in nature and will be finalized in the planned 1969 Edition of NFPA No. 58.

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