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STANDARDS
for the
Storage and Handling of
LIQUEFIED PETROLEUM GASES

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National Fire Protection Association

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The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and ninety national and regional societies and associations (list on outside back cover) and over fifteen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association; a complete list is available without charge on request. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire-safety.

Definitions

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

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

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Standards for the Storage and Handling of Liquefied Petroleum Gases

NFPA No. 58-1954

The NFPA Committee on Gases has been preparing good practice recommendations and standards on the use of liquefied petroleum gases for 30 years, having been active in this field since 1924. As a result of the consistent effort to prepare technically adequate and practical standards on this subject during all these years, the NFPA standards are today either adopted in full or used in reference by a majority of the U. S. States and Canadian Provinces and are followed by virtually the entire industry.

The present edition incorporates the amendments adopted at the 58th Annual Meeting of the Association held in Washington, D. C., May 17-21, 1954 on recommendation of the Committee on Gases. It supersedes all prior editions.

In 1940, various separate standards involving the use of LP Gas were consolidated under this standard. Since that time further revisions were adopted by the NFPA in editions published in 1943, 1946, 1948, 1951, 1952, 1953. Rapid development in the utilization of LP Gas has necessitated frequent changes in these standards. Prior editions of this standard have been adopted and published by NBFU.

The National Fire Protection Association has also adopted "Standards for the Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants" (No. 59) and "Standards for Liquefied Petroleum Gas Piping and Appliance Installations in Buildings" (No. 52). Copies are available from the Association.

CONTENTS.

INTRODUCTION.

The terms "liquefied petroleum gases", "LPG" and "LP Gas" as used in these standards 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.

In the interest of safety it is important that employees understand the properties of these gases, and that they be thoroughly trained in safe practices for handling, distribution and operation.

Under moderate pressure the gases liquefy, but upon relief 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 manufactured gas.

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.

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.

Application of Rules.

(a) The following standards are intended to apply to the design, construction, location, and operation of liquefied petroleum gas installations. These standards do not apply to marine or pipe line terminals, natural gasoline plants, refineries or tank farms*; nor do they apply to 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.

(b) "Basic Rules" apply to all divisions except Division V, and unless noted in "Basic Rules."

(c) Division I—"bottled gas"—applies to installations utilizing containers constructed in accordance with Interstate Commerce Commission specifications.

(d) Division II applies to installations utilizing containers other than those constructed in accordance with Interstate Commerce Commission specifications.

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

(f) 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.).

*Tank farms do not include storage located in industrial installations.

(g) Division V applies to the storage of containers not installed for use at final utilization point.

(h) Division VI applies to cylinder systems for cooking and heating installations on highway mobile vehicles.

(i) Division VII applies to liquefied petroleum gas service stations where fuel is dispensed into containers of self propelled internal combustion engines complying with provisions of Division IV.

(j) Where liquefied petroleum gas is used with oxygen, NFPA Standards for the Installation and Operation of Gas Systems for Welding and Cutting (NFPA No. 51)* shall apply.

(k) Where liquefied petroleum gas is used in Utility Gas plants, NFPA Standards for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants (NFPA No. 59)† shall apply.

(l) When reference is made to gas in these standards it shall refer to liquefied petroleum gases in either the liquid or gaseous state.

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

(n) The term "systems" as used in these standards refers to an assembly of equipment consisting essentially of the container or containers, major devices such as vaporizers, relief valves, excess flow valves, regulators, etc., and piping connecting such parts.

(o) The abbreviations "psig" and "psia" as used in these standards refer to pounds per square inch gauge and pounds per square inch absolute, respectively.

Submittal of Plans.

For industrial installations utilizing storage containers of over 2000 gallons water capacity, plans shall be submitted to the authority having jurisdiction before construction.

*Published in National Fire Codes, Volume I, 1954, and in separate pamphlet form, available from the NFPA and in Pamphlet No. 51, published by the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

†Published in National Fire Codes, Volume I, 1954, and in separate pamphlet form available from the NFPA and in Pamphlet No. 59, published by the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

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 a distinctive odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of combustibility; provided, however, that odorization is not required if harmful in the use or further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

NOTE: The lower limits of combustibility of the more commonly used liquefied petroleum gases are: Propane, 2.15 per cent; Butane, 1.55 per cent. These figures represent volumetric percentages of gas in gas-air mixtures in each case.

B.2. Approval of Equipment and Systems.

(a) Each system utilizing I.C.C. containers shall have their container valves, connectors, manifold valve assemblies, and regulators (bases, hoods or cabinets if desired):

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

(b) Each system for domestic and/or commercial use utilizing containers of 2,000 gallons or less water capacity, other than those constructed in accordance with I.C.C. specifications, shall be:

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

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

1. Testing and listing by Underwriters' Laboratories, Inc., or,
2. Testing and 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, except as provided in 4.2(d), and VI, except as provided

in 6.1(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.

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.

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 by the National Fire Protection Association for the Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58)* in effect at the time of fabrication.

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

B.4. Markings on Containers.

(a) Each container or system covered in Divisions II, III, IV, except as provided in Par. 4.2(d) and VII 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 & Pressure Vessel Inspectors.

Underground: Container and system nameplate.
Aboveground: Container.

2. With notation as to whether system is designed for underground or aboveground installation.

Underground and aboveground: System nameplate.

*As published by the National Fire Protection Association or by the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

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

Underground and aboveground: System nameplate.

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

Underground: Container and system nameplate.
Aboveground: Container.

5. With the working pressure in pounds per sq. in. for which the container is designed.

Underground: Container and system nameplate.
Aboveground: Container.

6. With the wording "This container shall not contain a product having a vapor pressure in excess of—p.s.i. gauge at 100° F." See B.13(e).

Underground and aboveground: System nameplate or tag on filler connection.

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

Underground: No requirement.
Aboveground: Container.

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.

Aboveground and Underground: System nameplate or on liquid level gauging device.

9. With the outside surface area in square feet.

Underground: System nameplate.
Aboveground: Container.

(b) Markings specified on "container" shall be on the container itself. Markings specified on "system nameplate" shall be on a metal tag or nameplate attached to the system, located in such a manner as to be readily visible.

B.5. Location of Containers and Regulating Equipment.

(a) Containers and first stage regulating equipment shall be located outside of buildings other than buildings especially provided for this purpose, except an I.C.C. container having a maximum water capacity of 12 pounds temporarily used for demonstration purposes.

(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 the following table:

Water Capacity Per Container	Minimum Distances		
	Containers		Bet. Aboveground containers
	Underground	Aboveground	
Less than 125 gallons	10 feet	None	None
125 to 500 gallons	10 feet	10 feet	3 ft.
501 to 2,000 gallons	25 feet	25 feet	3 ft.
Over 2,000 gallons	50 feet	50 feet	5 ft.

(c) No containers while installed for use shall 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.

(e) In industrial installations involving containers of 150,000 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 designed and constructed in accordance with good engineering practice.

(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 ft. to such gas manufacturing and distributing buildings.

(g) Any container used in domestic or commercial service, where transfer of liquid is made from such containers into portable containers such as on tractors, skid tanks, or similar applications shall be located not less than 50 feet from nearest important building. Special attention shall be given to maintaining the above distances on such transferring in trailer camps with respect to any trailer, except as provided in paragraph 6.12.

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

(i) The minimum separation between liquefied petroleum gas containers and flammable liquid tanks or containers shall

be 20 feet, and the minimum separation between a container and the center line of the dike shall be 10 feet.

(j) 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.

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

B.6. Container Valves and Accessories.

(a) All shut-off valves and accessory equipment (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 and accessories which may be subjected to container pressure shall have a rated working pressure of at least 250 pounds per square inch gauge.

(b) All connections to containers, except safety relief connections, liquid level gauging devices and plugged openings, shall have shut-off valves located as close to the container as practicable [except as provided in B.6(e)].

(c) Excess flow valves where required by these standards 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 gauging 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 tank or through fittings attached directly on tank to which pressure gauge connection is made need not be equipped with shut-off or excess flow valves if such openings are restricted to not larger than No. 54 drill size opening.

(f) Excess flow and back pressure check valves where required by these standards 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 except as provided in Par. 6.12. (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.

B.7. Piping, Tubing, and Fittings.

(a) Piping, except as provided in Division IV, par. 4.5(a) and Division VI, par. 6.9(c), shall be wrought iron or steel (black or galvanized), brass or copper pipe; or seamless copper, brass, steel or aluminum tubing. All piping or tubing shall be suitable for a working pressure of not less than 125 pounds per square inch. Copper tubing may be of the standard grade K or L., or equivalent and shall have a minimum wall thickness of 0.032 inches. Aluminum tubing shall not be used in exterior locations or where it is in contact with masonry or plaster walls or insulation.

(b) In systems where the gas in liquid form without pressure reduction enters the building [see B.12(a)] only heavy walled seamless brass or copper tubing with an internal diameter not greater than 3/32 inch, and a wall thickness of not less than 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.

(c) Pipe joints may be screwed, flanged, welded, soldered or brazed, with a material having a melting point exceeding 1000° F. For operating pressures of 125 pounds per square inch gauge or less, fittings shall be designed for a pressure of at least 125 pounds per square inch gauge. For operating pressures above this, fittings shall be designed for a minimum of 250 pounds per square inch gauge. Cast iron fittings shall be prohibited. Joints on seamless copper, brass, steel or nonferrous gas tubing shall be made by means of approved gas tubing fittings, or soldered or brazed with a material having a melting point exceeding 1000° F.

(d) 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.

(e) Approved flexible hose may be used on the low pressure side of the system as follows:

1. Only appliances which are necessarily portable or which have to be moved from place to place or which require a vibration joint, may be connected with flexible hose. On such appliances the shut-off shall be in the solid connection or piping only, and not at the appliance end of the hose; industrial equipment is exempt from this provision.

2. Only approved hose of proper design and good quality shall be used, and it shall be securely attached to each end.

3. The key of the shut-off on an independent connection shall not be within 6 inches of the key of any other shut-off. In such an installation the keys shall be in directions perpendicular to each other so that the possibility of the accidental turning on of the gas at the wrong shut-off will be lessened.

4. Where flexible hose is used, a shut-off shall not be placed close to the floor or in any other position where it may be turned on by accident.

5. A wall outlet to which an appliance is to be connected with flexible hose shall be so placed as to reduce to a minimum the passing to and fro across the hose. Where flexible hose is used, it shall be of the minimum practicable length. Extending hose from one room to another is prohibited.

6. Where an appliance, such as a gas iron for industrial work, is always used in the same location, but its operation demands a flexible hose, the flexible hose shall be permanently attached at the supply end by a threaded or other secure metal connection, and the appliance end shall be provided with a secure metal joint, which can be conveniently made and separated, in preference to a rubber slip end.

7. Where the hose is likely to be subjected to excessive temperatures, either through accident or because of the special nature of the appliance, only hose properly protected or made up of noncombustible material shall be used.

(f) 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.

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

(h) Piping outside buildings may be buried, above ground, 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.

B.8. Hose Specifications.

(a) Hose shall be fabricated of materials that are resistant to the action of liquefied petroleum gases in the liquid phase.

(b) Hose subject to container pressure shall be designed for a bursting pressure of not less than five times the vapor pressure of the product at 100° F. for which the container was designed. Hose connections when made shall be capable of withstanding a test pressure of twice the vapor pressure of the product at 100° F. for which the container is designed.

(c) Hose and hose connections located on the low pressure side of regulators or reducing valves shall be designed for a bursting pressure of not less than 125 psig. but not less than five times the pressure setting of the safety relief devices protecting that portion of the system. All connections shall be so designed that there will be no leakage when connected.

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

B.9. Safety Devices.

(a) Every container except those constructed in accordance with I.C.C. specifications and every vaporizer (except motor fuel vaporizers and except vaporizers described in B.10(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 ft. 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 as follows, with relation to the design working pressure of the container:

Containers	Minimum	Maximum
ASME Code; Par. U-68, U-69—1949 and earlier editions	110%	125%
ASME Code; Par. U-200, U-201—1949 edition	88	100
ASME Code—1950 and 1952 editions	88	100
API-ASME Code—All editions	88	100
I.C.C.	As approved by Bureau of Explosives	

(c) Safety relief devices used with systems employing containers other than those constructed according to I.C.C. 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% of the maximum permitted start to discharge pressure setting of the device. Such valves shall also be rated according to the requirements of the 1950 and 1952 editions of the ASME Unfired Pressure Vessel Code.

(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 so arranged 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.

(f) No shut-off valves shall be installed between the safety relief valves and the container except that a shut-off valve may be used where the arrangement of this valve is such as always to afford full required capacity flow through the relief valves.

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 shut-off valves. In this case the two shut-off 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.

(h) Each container safety relief valve used with systems covered by Divisions II, III, IV except as provided in 4.2(d); VI except as provided in 6.1(a); and in Division VII 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 p.s.i. gauge at which the valve is set to start to discharge; the actual rate of discharge of the valve in cubic feet per minute of air at 60° F. and 14.7 pounds per square inch, absolute; 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 p.s.i. gauge; and that its rate of discharge [see Section B.9(b) and (c)] is 4050 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 of the 1952 edition of NFPA Standard No. 58.

NOTE 2: Frequent testing of safety relief 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 forever, hence it is suggested that in the case of containers exceeding 2000 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 safety relief valve shall be installed between each pair of shut-off valves on liquefied petroleum gas liquid piping so as to relieve into a safe atmosphere. It is recommended that the start-to-discharge pressure of such relief valves be not in excess of 500 pounds per square inch gauge.

(k) The discharge from the safety relief device of a stationary container shall not terminate in any building, nor beneath any building.

B.10. Vaporizer and Housing.

NOTE: B.10 does not apply to motor fuel vaporizers. See Div. IV, Sec. 4.7.

(a) Indirect fired vaporizers utilizing steam, water or other heated 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.

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 which are exempted by paragraph U-1(a) of the 1949 and earlier editions and paragraph U-1(d) of the 1950 edition of the ASME Unfired Pressure Vessel Code shall have a design working pressure of not less than 250 p.s.i. gauge 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, non-combustible 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 Section 2.3(e)(1).

6. Vaporizers shall be provided with suitable automatic means to prevent liquid passing from 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 vapor tight 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 Section 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 shut-off 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 shut-off valves. Vaporizers having a capacity greater than 100 gallons per hour shall be located at least 15 feet from container shut-off valves.

3. Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for gas manufacturing or distribution. Such structures shall be of noncombustible construction or equivalent, and well ventilated near the floor line and roof. See Section B.9(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 2000 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 air-tight non-combustible partition or partitions.

9. Except as provided in Sec. B.10(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 ft. for vaporizers having a capacity of 15 gallons per hour or less vaporizing capacity.

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

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

10. No direct fired vaporizer shall raise the product pressure within the storage container over the pressure set out in the second column of table in Section 2.1(a).

11. No direct fired vaporizer shall be connected to a container that has a storage capacity in gallons, less than 10 times the hourly capacity of the vaporizer in gallons.

12. Vaporizers shall not be provided with fusible plugs.

13. Vaporizer 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 2000 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 ft. for storage containers of less than 500 gallons water capacity.
25 ft. for storage containers of 500 to 1200 gallons water capacity.
50 ft. for storage containers of over 1200 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 Section 2.1(a).

9. No direct fired tank heater shall be connected to a container that has a storage capacity in gallons, less than 10 times the hourly vaporizing capacity of the tank heater in gallons.

B.11. 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 following filling densities:

MAXIMUM PERMITTED FILLING DENSITY.

Specific Gravity at 60°	Aboveground Containers 0 to 1200 Gals. Total Water Cap.	Aboveground Containers Over 1200 Gals. Total Water Cap.	Underground Containers All Capacities
.473—.480	38%	41%	42%
.481—.488	39	42	43
.489—.495	40	43	44
.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
.601—.608	54	57	58
.609—.617	55	58	59
.618—.626	56	59	60
.627—.634	57	60	61

(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.

(c) The maximum liquid volume in per cent of total container capacity shown in Appendix D may be used in lieu of the preceding Table B.11(a) to determine the maximum quantity that may be placed in a container.

(d) Any container including mobile cargo tanks and portable tank containers regardless of size or construction, shipped under I.C.C. jurisdiction or constructed in accordance with I.C.C. Specifications shall be charged according to I.C.C. requirements.

B.12. Liquid Inside Building.

(a) No gas in the liquid phase shall be piped into any building for fuel purposes except:

1. Buildings devoted exclusively to housing equipment for vaporization, pressure reduction, gas mixing, gas manufacturing or distribution.
2. Buildings, or separate fire divisions of buildings, used exclusively for housing internal combustion engines.
3. In domestic installations no liquid or gas shall be piped into a building at more than 20 p.s.i. gauge pressure. The initial pressure reducing devices shall be installed outside the building.
4. Buildings, or in separate fire divisions of buildings, used exclusively for research and experimental laboratories.

B.13. 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) 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)].

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

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

(f) 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.

(g) 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.

When low temperatures so reduce the vapor pressure that the compressor will not function satisfactorily, the compressor may take suction directly from the air and discharge through a suitable moisture removing medium to the container being emptied.

B.14. 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 I.C.C. (Interstate Commerce Commission) rules, shall be installed at the active end or ends of the siding while the tank car is connected for unloading.

(c) While cars are on sidetrack for unloading, the wheels at both ends shall be blocked on the rails.

(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 back flow 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.5(a), except that lesser distances may be used, keeping in mind the above items and upon approval of the authority having jurisdiction.

B.15. Instructions.

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

B.16. Electrical Connections and Open Flames.

(a) All electrical equipment in vaporizer houses, except those housing direct fired vaporizers, pumphouses and cylinder filling rooms, or other similar locations shall be of the type approved for use in Class I, Group D, Hazardous Locations of the National Electrical Code.

(b) Open flames or other sources of ignition shall not be permitted in vaporizing houses except those housing direct fired vaporizers, pump houses, container charging rooms, or other similar locations. No direct fired vaporizers shall be permitted in pumphouses or container charging rooms.

B.17. Liquid Level Gauging Device.

(a) Containers, including I.C.C. cylinders, with water capacity less than 200 lbs. shall be charged by weight, except containers covered by Div. IV.

(b) Each container, except containers charged by weight, shall be equipped with a liquid level gauging device of approved design. These gauges shall be used in charging containers as required in B.11.

(c) All gauging devices shall be arranged so that the maximum liquid level for butane, for a 50-50 mixture of butane and propane, and for propane, to which the container may be charged is readily determinable. The gallonage capacity (B.11), whether for cylindrical or spherical containers, and whether for use with aboveground or underground containers shall be marked on either the system nameplate or gauging device or part may be on the system nameplate and part on the gauging device.

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

(e) Gauging devices shall have a design working pressure of at least 250 lb. per square inch gauge.

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

(g) When a fixed tube device is used on containers other than I.C.C., the length of the dip tube, expressed in inches carried out to one decimal place and prefixed with the letters "DT," shall be stamped on the exterior of the device. When a fixed tube device is used on I.C.C. containers, the length of the dip tube expressed in inches carried out to one decimal place and prefixed with the letters "DT" shall be stamped on the exterior of the device and on the container.

(h) Gauge 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 gauge manufacturer. They shall be shielded against the direct rays of the sun. Gauge 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.

(i) Gauging 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.18. Use of Approved Appliances.

(a) New domestic and commercial gas consuming appliances shall not be installed unless their correctness as to design, construction and performance is certified by one of the following:

1. Determined by a nationally recognized testing agency adequately equipped and competent to perform such services and shall be evidenced by the attachment of its seal or label to such gas appliances. This agency shall be one which maintains a program of national inspection of production models of gas appliances at least once each year on the manufacturer's premises. Approval by the American Gas Association Laboratories, as evidenced by the attachment of its listing symbol or Approval Seal to gas appliances and a certificate or letter certifying approval under the above-mentioned requirements, or listing by Underwriters' Laboratories, Inc., shall be considered as constituting compliance with the provisions of this section.
2. Approval by the authority having jurisdiction.

(b) 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.

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.

1.1. Marking of Containers.

(a) All 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. Location of Containers and Regulating Equipment.

(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 three feet away from any building opening which is below the level of such outlet. Except as provided in Sec. 1.7, the discharge from safety reliefs shall be located not less than three feet horizontally away from any building opening which is below the level of such discharge. Discharge from any safety relief device shall not terminate in any building, nor beneath any building unless such space is well ventilated to the outside.

(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. 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 locks is not usually 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 which are recharged at the installation 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 or equalizing connections.

1.5. Safety Devices.

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

(b) When the delivery pressure from the final stage regulator is not more than 5 lb. the low pressure side shall be equipped with a relief valve, set to start to discharge at not less than two times, and not more than three times the delivery pressure, but not more than 5 pounds in excess of the delivery pressure. When the delivery pressure is more than 5 pounds the relief valve shall be set to start to discharge at not less than 1¼ times and not more than two times the delivery pressure. This requirement may be waived

on liquid feed systems utilizing tubing specified in B.7(b). When a regulator or pressure relief valve is installed inside a building for other than demonstration purposes [see Par. B.5(a)], 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; nor to Section 1.7. In buildings devoted exclusively to gas distribution purposes, the space above the diaphragm need not be vented to the outside.)

1.6. Reinstallation of Containers.

(a) If due to be retested, containers shall not be reinstalled until they have been retested and otherwise maintained in accordance with currently effective regulations of the I.C.C.

1.7. Use of Gas for Industrial Applications Where Oxygen Is Not Required.

(a) Where portability of containers is necessary making their location outside the building or structure impracticable, containers may be located for use but not for storage inside the building or structure, only: where gas is to be used for industrial processing or repair work in an industrial building or structure being employed for industrial purposes; or where it is to be used in the construction, repair or improvement of buildings or structures and their fixtures and equipment. Such installations are subject to the following additional rules:

1. The regulator employed may be connected directly to the cylinder valve or located on a manifold which is connected to the cylinder valve. The regulator must be of a type suitable for use with liquefied petroleum gas.
2. The aggregate capacity of the containers connected to each portable manifold shall not exceed 300 pounds of gas by weight, and not more than one such manifold with containers may be located in the same room unless separated by at least 50 feet.
3. Manifolds and fittings connecting containers to the pressure reducing regulator inlets shall be designed to withstand without rupture at least 500 p.s.i. gauge.
4. Containers, regulating equipment and manifolds, shall be located where they are not subjected to excessive rise in temperature, physical damage or tampering by unauthorized persons.

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.

DIVISION II.

SYSTEMS UTILIZING CONTAINERS OTHER THAN I.C.C.

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.

2.1. Design Working Pressure and Classification of Storage Containers.

(a) Storage containers shall be designed and classified as follows:

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gauge at 100°F.	Minimum Design Working Pressure of Container lb. per sq. in. gauge	
		1949 and earlier edition of ASME Code; Par.U-68, U-69	1949 edition of ASME Code: Par. U-200, U-201; 1950 and 1952 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 working 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 working 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 and 1952 editions of the ASME Code, and (3) all editions of the API-ASME Code.

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.

(b) The shell or head thickness of any container shall not be less than 3/16 inch.

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.5(a), 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 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 shut-off 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 gauging devices as provided in B.6(d), B.17(d) and B.17(i); pressure gauge connections as provided in B.6(e), as provided in 2.2(d) and (f) and (g).

(d) No excess flow valve is 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 shut-off 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 shut-off 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 shut-off valve does not exceed $\frac{5}{16}$ in. in diameter for vapor withdrawal systems and $\frac{1}{8}$ in. in diameter for liquid withdrawal systems.

5. An approved pressure-reducing regulator is directly attached to the outlet of the shut-off valve and is rigidly supported, or that an approved pressure-reducing regulator is attached to the outlet of the shut-off 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 gauging devices and pressure gauges 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.

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 setting 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 gauge.

6. When the delivery pressure from the final stage regulator is not more than 5 pounds, the low pressure side shall be equipped with a relief valve, set to start to discharge at not less than two times, and not more than three times the delivery pressure, but not more than 5 pounds in excess of the delivery pressure. When the delivery pressure is more than 5 pounds, the relief valve shall be set to not less than 1¼ times and not more than two times the delivery pressure. This requirement may

be waived on liquid feed systems utilizing tubing specified in B.7(b). 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 5 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.)

7. Discharge from any safety relief device shall not terminate in any building; nor beneath any building unless such space is well ventilated 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, either permanently or temporarily, shall have the rate of discharge specified in Appendix A provided by spring-loaded relief valve or valves, or by a combination of such relief valves and suitable fuse plugs; provided the total discharge area of the fuse plugs in each container does not exceed .25 sq. in. and the spring-loaded relief valve provides at least 30% of the required rate of discharge.

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.9i].

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 seven feet above the container, 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 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.9i)

(c) UNDERGROUND CONTAINERS: On containers of 2,000 gallons water capacity or less, 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 installed underground may be reinstalled underground or aboveground if they do not show evidence of harmful external corrosion or other damage. Where containers are reinstalled underground, the corrosion-resistant coating shall be put in good condition. (See Paragraph 2.6(e), see also Sec. 2.3 for relief valve requirements.)

2.5. Capacity of Liquid Containers.

No liquid storage container shall exceed 30,000 standard U. S. gallons water capacity.

2.6. Installation of Storage Containers.

(a) Containers installed aboveground except as provided in Par. 2.6(f) 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. Every container shall be so supported as to prevent the concentration of excessive loads on the supporting portion of the shell. 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 1,200 gallons water capacity or less may be installed with non-fireproofed ferrous metal supports if mounted on concrete pads or footings, and if the distance from the outside bottom of the container shell to the ground does not exceed 24 in.

(c) Any container may be installed with non-fireproofed 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 five (5) feet, provided the container is in an isolated location and such installation is approved by the authority having jurisdiction.

(d) Containers buried underground shall be so placed that the top of container is not less than 2 feet below the surface of the ground, except that where ground conditions make compliance with this requirement impracticable, installation shall be made otherwise to prevent physical damage. It will not be necessary to cover the portion of the container to which manhole and other connections are affixed. When necessary to prevent floating, containers shall be securely anchored or weighted.

(e) Underground containers shall be set on a firm foundation (firm earth may be used) and surrounded with soft earth or sand well tamped in place. As a further means of resisting corrosion, the container, prior to being placed underground, shall be given a protective coating satisfactory to the authority having jurisdiction. Such protective coating shall be equivalent to hot dip galvanizing, or to two preliminary coatings of red lead followed by a heavy coating of coal tar or asphalt, and the container thus coated shall be so lowered into place as to prevent abrasion or other damage to the coating.

(f) 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 de-

signed, installed and used in accordance with these rules subject to the following provisions: (See also Sec. 3.16.)

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 ft. 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.

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

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

(i) 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 non-metallic hose is prohibited for interconnecting such containers.

2.7. Dikes and Embankments.

(a) Because of the pronounced volatility of liquefied petroleum gases, dikes are not normally necessary, hence their general requirement 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 Tank Accessories, Grounding.

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

NOTE: The use of locks is not usually desirable because it prevents access in case of emergency.

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

(c) Aboveground containers exceeding 2,000 gallons water capacity shall be electrically grounded in an effective manner. (See NFPA pamphlet on Static Electricity, NFPA No. 77.)

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 re-vaporization of the condensate.

2.10. Instructions.

For installations which require operation of equipment by the user, instructions shall be furnished to the personnel responsible for the operation of the system.

2.11. Damage from Vehicles.

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

2.12. 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.

2.13. General Provisions Applicable to Bulk Filling Plants and Systems in Industrial Plants.

(a) Where standard watch service is provided it shall be extended to the LP Gas installations and personnel properly trained.

(b) 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) The container storage area shall be fenced with "man-proof" fencing or otherwise protected where necessary, and at least two means of access through the fencing shall be provided.

2.14. Container Charging Plants.

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

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

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

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

(c) The pumps and compressors may be located in the container charging room or building but if they are housed in one or more separate buildings they shall be located not less than:

1. 10 ft. from bulk storage tanks.
2. 25 ft. from line of adjoining property which may be built upon.
3. 25 ft. from sources of ignition.

(d) Where a part of the container charging building is to be used for a boiler room or where open flames or similar sources of

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

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 gas tight joint.

2.15. Fire Protection.

(a) 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.

(b) 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.

2.16. Painting.

(a) Aboveground containers shall be kept properly painted.

2.17. Lighting.

(a) At the discretion of the authority having jurisdiction, industrial installations shall be illuminated.

2.18. Vaporizers for Internal Combustion Engines.

(a) The provisions of Section 4.7 shall apply.

2.19. Gas Regulating and Mixing Equipment for Internal Combustion Engines.

(a) The provisions of Section 4.8 shall apply.

DIVISION III.

TANK TRUCKS, SEMI-TRAILERS AND TRAILERS FOR TRANSPORTATION OF LIQUEFIED PETROLEUM GASES.

Division III applies specifically to containers and pertinent equipment mounted on trucks, semi-trailers and trailers used for the transportation of liquefied petroleum gases. All Basic Rules apply to this Division unless otherwise noted in the Basic Rules.

Containers and pertinent equipment for tank trucks and trailers for the transportation of liquefied petroleum gas, in addition to complying with the requirements of these standards, should also comply with the requirements of the Interstate Commerce Commission and those of any other regulatory body which may apply.

3.1. Design Working Pressure and Classification of Containers.

(a) Containers shall be designed and classified as follows:

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gauge at 100°F.	Minimum Design Working Pressure of Container lb. per sq. in. gauge: 1949 and earlier edition of ASME Code; Par. U-68, U-69	Minimum Design Working Pressure of Container lb. per sq. in. gauge: 1949 edition of ASME Code: Par. U-200, U-201; 1950 and 1952 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 working 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 working 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 and 1952 editions of the ASME Code, and (3) all editions of the API-ASME Code.

(b) The shell or head thickness of any container shall not be less than 3/16 inch.

3.2. Container Valves and Accessories.

(a) All valves shall be safeguarded against physical damage due to collision, overturning or other emergency.

(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 Sec. 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 shut-off valve.

(c) All other connections to containers, except safety relief and liquid level gauge connections, shall be provided with suitable automatic excess flow valves, or in lieu thereof may be fitted with quick-closing internal valves, which, except during delivery operations, shall remain closed. The control mechanism for such valves may be provided with a secondary control remote from the delivery connections and such control mechanism shall be provided with a fusible section (melting point not over 220° F.) which will cause the internal valve to close automatically in case of fire.

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

(e) Each container shall be equipped with a suitable pressure gauge.

3.3. Piping and Fittings.

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

(b) All ferrous threaded fittings and threaded pipe shall be designed for a minimum working pressure of 250 p.s.i.g.

3.4. Safety 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; loose fitting rain caps shall be used. 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) 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.

(c) If tank filling connections are located at a distance of more than 20 feet from the truck, the pump discharge shall be provided with an excess flow valve to prevent escape of liquid in the event of hose or connection failure beyond the pump.

3.5. Tank Truck Fuel Systems.

(a) 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) LOADING TRUCK, TRAILER, AND SEMI-TRAILER CONTAINERS. Truck, trailer, and semi-trailer containers shall be loaded by weight, by meter, or by suitable liquid level gauging device (see Sec. B.17).

(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. The pumps, except constant speed centrifugal pumps, shall be equipped with suitable pressure actuated by-pass valves permitting flow from pump discharge to pump suction or back to container when the pump discharge pressure rises above a predetermined point. Pump discharge from positive displacement pumps shall also be equipped with a spring-loaded safety valve of non-leaking type, set at a pressure not to exceed 35 per cent higher than the predetermined setting of the by-pass valve.

3.7. Mounting Containers on Truck, Semi-Trailer or Trailer Vehicle.

(a) A suitable "stop" or "stops" shall be mounted on the truck, semi-trailer or trailer or on the container, in such a way that the container shall not be dislodged from its mounting due to the vehicle coming to a sudden stop. Back slippage shall also be prevented by proper methods.

(b) A suitable "hold down" device shall be provided which will anchor the container at one or more places on each side of the container to the truck, semi-trailer or trailer frame so as to minimize loosening due to vibration.

3.8. Electrical Equipment and Lighting.

(a) Tank trucks, tank trailers, and tank semi-trailers, shall not be equipped with any artificial light other than electricity. 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) All 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) Where 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.

3.10. Metallic Connections.

(a) 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 muffler and exhaust pipe shall be placed as far as practicable from any tank valves, pumps or piping.

(b) Muffler cut-out shall not be used.

3.12. Extinguishers Required.

(a) Each truck or tractor shall be provided with at least one approved hand fire extinguisher of a type suitable for gas fires. Extinguishers of the dry chemical or carbon dioxide type are suitable. Extinguishers should have a net content of not less than 15 pounds.

3.13. Smoking Prohibited.

(a) Tank truck drivers and their helpers shall be instructed not to smoke or allow smoking around the truck on the road, while making deliveries, filling the trucks or making any repairs to tank truck or tank trailer.

3.14. Protection Against Collision.

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

3.15. Chock Blocks.

(a) Chock blocks shall be provided for the rear wheels and chained permanently to the vehicle. Such blocks shall be stored in suitable carriers when not in use. These blocks shall be placed at rear wheels to prevent rolling of the vehicle whenever it is parked including loading and unloading operations.

3.16. Skid Tanks.

(a) Skid tanks shall not be used in place of tank trucks, tank trailers or tank semi-trailers for regular deliveries. They shall be employed only where there is a necessity for their joint use as a transport and storage unit. Where skid tanks are used they shall comply with all requirements of this Division and with Section 2.6(f).

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 moveable, 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 these Standards. 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 containers of a truck while in transit, but not from cargo containers on trailers or semi-trailers. The use of fuel from the cargo containers to operate stationary engines is permitted providing wheels are securely blocked.

(b) Passenger carrying vehicles shall not be fueled with passengers aboard.

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

4.2. Design Working Pressure and Classification of Fuel Containers.

(a) Fuel containers for use on other than industrial tractors and lift trucks shall be designed and classified as follows:

		Minimum Design Working Pressure of Container lb. per sq. in. gauge	
Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gauge at 100° F.	1949 and earlier edition of ASME Code; Par. U-68, U-69	1949 edition of ASME Code: Par. U-200, U-201; 1950 and 1952 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 working 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 working 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 and 1952 editions of the ASME Code, and (3) all editions of the API-ASME Code.

(b) Fuel containers for use in industrial tractors and lift trucks shall be either ICC type 4B240, or minimum container type 250* if ASME.

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

(d) 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 section, except construction and marking requirements.

4.3. Location of Fuel Supply 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 practicable, and the passenger space shall be sealed from the container space to prevent direct seepage of gas to the passenger space. 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.

(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) Fuel containers for engine on buses, except taxi cabs, shall be permanently installed. Proper anchorage shall be provided to prevent jarring loose, slipping, or rotating of cylinders.

(d) Containers shall be secured in place on the vehicle by fastenings designed and constructed with minimum factor of safety of four to withstand loadings in any direction equal to four times the filled weight of the container. Field welding where necessary shall be made only on saddle plates, lugs, or brackets, originally attached to the container by the tank manufacturer.

(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.

*Refer to footnote below table on page 58-41 for increasing container type

4.4. Valves and Accessories.

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

(b) The filling connection* shall be fitted with an approved double back-pressure check valve, or a positive shut-off in conjunction with an internal back-pressure check valve. On a removable container the filler valve may be a hand operated shut-off valve with an internal excess flow valve. Main shut-off 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 paragraph B.2.

(d) Liquid level gauging devices:

1. Variable liquid level gauges which require the venting of fuel to the atmosphere shall not be used on fuel containers of industrial tractors and lift trucks.

2. Permanently mounted fuel containers shall be equipped with a fixed length dip tube gauge, 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 gauging 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

*To minimize pressure build-up while filling the container, it is recommended that the fueling connection terminate in the vapor space of the container.

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, Tubing and Fittings.

(a) All piping from fuel container to first stage regulator shall be wrought iron or steel (black or galvanized), brass or copper pipe; or seamless copper, brass or steel tubing. Steel pipe or tubing shall have a minimum wall thickness of 0.049 inches, and 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.8) 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 piping 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.9).

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

(b) The discharge outlet from safety relief devices 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. Loose fitting raincaps shall be used.

(c) When a discharge line from the container safety relief device is used, it shall be sized and located and maintained so as not to interfere with the required flow of gas from the safety relief device. 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.

4.7. Vaporizers.

(a) Vaporizers and any part thereof and other devices that may be subjected to container pressure, shall have a design working pressure of at least 250 lb. per sq. in. gauge.

(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 working pressure of the fuel containing portion in lbs. per sq. in. gauge.

(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 shut-off 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 engine is not running. Except in the case of engines installed in buildings, trucks (including industrial tractors and lift trucks), and passenger carrying vehicles, an atmospheric type regulator (zero governor) may be considered adequate for the shut-off device.

(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 or Portable Engines in Buildings.

(a) All engine rooms shall be well ventilated at the floor level.

(b) When engines are installed below grade level, suitable floor level mechanical exhaust ventilation shall be provided and operated continuously or adequate means shall be provided to purge the room before the engine is started. In any case the mechanical ventilation shall be in operation when the engine is running. Before and during any repairs to the engine the room shall be ventilated.

(c) Automatic fire doors shall be provided at openings in the engine room that open into other sections of the building.

(d) Exhaust gases shall be discharged outside the building in a manner that will not create a fire or any other hazard.

(e) Regulators and pressure relief valves installed in buildings and engine rooms shall be vented to the outside and discharge at least five feet away from any building opening.

DIVISION V.

STORAGE OF CONTAINERS NOT INSTALLED FOR USE AT FINAL UTILIZATION POINT.

Containers stored or in the process of charging or handling at container charging plants with permanently located bulk storage tanks or at plants devoted primarily to the storage and distribution of other petroleum products are not covered by the provisions of this division.

5.1. Storage on Premises of User.

(a) Containers on the premises of users that are not in use or connected for use shall be stored according to the requirements applying to containers connected for use in Section B.5; except that portable I.C.C. containers on the premises of industrial users may be stored as follows:

1. Cylinders, stored inside a building except those in actual use or attached ready for use, shall be limited to a total capacity of 2,000 cubic feet. For storage in excess of 2,000 cubic feet total gas capacity, cylinders shall be kept outside or in a separate room or compartment or in a special building.

2. Cylinders may be stored in the open provided valves and safety devices are protected against accumulation of ice and snow. Cylinders permitted inside of buildings shall be stored away from highly combustible materials and in locations where they are not liable to excessive rise in temperature, physical damage or tampering by unauthorized persons. Empty cylinders shall have their valves closed in storage and when shipped.

3. Storage rooms or Compartments. Where cylinders are stored inside buildings*, they shall be enclosed in a separate room or compartment of ample size. The walls or partitions, floor and ceiling of such room or compartment shall be of one of the types of construction listed below or other construction equivalent in strength and fire resistance; walls or partitions shall be continuous from floor to ceiling and shall be securely anchored. At least one wall of an inside cylinder storage room shall be an exterior wall.

Gypsum or cement plaster at least ¾ of an inch thick on metal lath on each side of a stud partition.

Expanded metal lath encased in solid cement plaster not less than 2½ inches thick.

Reinforced concrete.

Brick.

*The word "buildings" as used in this section means a building having occupancy other than that directly associated with storage of containers, charged and empty or the manifolding of cylinders used in cutting and industrial purposes.

Tile, gypsum or concrete block (cement plaster on each side to a thickness of ¼ inch).

Openings from a cylinder storage room or compartment to other parts of the building shall be protected by a fire door classified and labeled as suitable for use in Class B situations as defined in the NFPA Standards for the Protection of Openings in Walls and Partitions Against Fire (NFPA No. 80).

The door shall be of the swinging type and close into a rabbet or otherwise be made tight to prevent passage of flame around edges; it shall be self-closing, and if fastened open, shall be arranged to close automatically in case of fire originating inside or outside of the cylinder storage room or compartment. Windows, if provided in partitions, shall be wired glass in approved metal frames.

Special buildings, rooms or compartments shall have no open flame for heating or lighting and shall be well ventilated. Empty cylinders shall be stored with valve end up, and cylinder cap in place.

5.2. Storage for Re-Sale.

(a) If containers other than I.C.C. contain any gas they shall be stored according to the requirements applying to such containers when connected for use in Section B.5.

(b) I.C.C. containers may be stored in a building, a separate room or compartment used exclusively for storing gas containers. Such room or compartment shall not be below ground level and shall have no openings communicating with other occupancies. The space below the floor shall be of solid fill or properly ventilated to open air. The building or compartment or room shall be vented top and bottom to the outside only and the outlet from such vents shall be at least 5 feet horizontally from any other opening into any building. Such storage of containers shall not be adjacent to a school, church, hospital, athletic field or other points of public gathering.

(c) Containers may be stored in the open provided they are stored within a suitable enclosure where necessary to prevent tampering. Containers shall not be stored adjacent to a school, church, hospital, athletic field or other points of public gathering. The valves and safety devices shall be protected against accumulations of ice and snow. Protective caps shall be deemed adequate.

(d) Where the storage exceeds 10,000 pounds of gas at one storage location, such storage shall be located at least twenty-five (25) feet from important buildings, or regularly busy main thoroughfares.

(e) Readily combustible material shall not be piled within ten (10) feet of containers, in storage. A warning, to keep open flames and fire away, shall be conspicuously posted.

(f) Containers containing LP Gas shall not be stored inside a store or place of business frequented by the public. However, I.C.C. specification containers having a maximum water capacity of 2½ pounds each, such as those used for hand torches and similar applications, may be stored or displayed in such buildings. This storage shall be limited to a total of 24 such units.

5.3. General.

(a) Containers in storage shall have valves closed even though they may be empty.

(b) Containers which require valve protecting caps shall have such caps in place hand tight while in storage.

DIVISION VI.

CYLINDER SYSTEMS FOR COOKING AND HEATING INSTALLATIONS ON HIGHWAY MOBILE VEHICLES.

Division VI applies specifically to systems using LP Gas on mobile and other highway mobile vehicles. All Basic Rules apply to Division VI unless otherwise noted in this division or in the Basic Rules.

Where liquefied petroleum gas is supplied from containers not mounted on and secured to the unit, Division 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) Cylinders fabricated and marked prior to July 1, 1949, according to the requirements of the ASME or the API-ASME Unfired Pressure Vessel Code, shall be acceptable provided they comply with all other requirements set forth in this Division.

6.2. Marking of Containers.

(a) All containers except those included in 6.1(b) shall be marked in accordance with the Interstate Commerce Commission regulations. Additional markings not in conflict with Interstate Commerce Commission regulations may be used.

6.3. Description of a Division VI System.

(a) A Division VI system shall include: housing, container bracket or support, containers, container valves, manifold valve assembly (two-cylinder systems), regulator and relief valves.

6.4. Location of Containers and Systems.

(a) No container shall 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 enclosed in a housing, and comprising a complete system shall be mounted on the chassis of the vehicle as close to the hitch as practicable.

(c) Systems may be installed in a recess that is vapor tight to the inside of the vehicle and accessible from and vented to the outside.

(d) There shall be no fuel connection between vehicle units such as a tractor and trailer.

(e) Container or container carrier shall be secured in place on the vehicle by fastenings designed and constructed with a minimum safety factor of four to withstand loading in any direction equal to four times the filled weight of the container.

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) Shut-off valves on the containers shall be protected 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 a blow from any direction equivalent to that of a 30-lb weight dropped 4 ft. Construction must be such that a blow will not be transmitted to valve.

6.6. Safety Devices.

(a) I.C.C. 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.9 hereof.

(c) The delivery side of the gas pressure regulator shall be equipped with a safety-relief device set to start to discharge at a pressure not less than 2 times and not more than 3 times the delivery pressure of the regulator.

(d) Whenever equipment, such as a cargo heater or cooler on commercial vehicles is of a type designed to be in operation during transit, an excess flow device shall be provided at the container and installed so that it will be actuated by a complete break in the downstream fuel supply. Devices incorporated in the regulating equipment if connected directly to the container outlet valve will comply with this requirement. All devices shall meet the specifications of B.6(c).

6.7. System Design and Service Line Pressure.

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

(b) Vapor, at a pressure not over 18-in. water column shall be delivered from the system into the service piping supplying the appliances.

6.8. System Enclosure and Mounting.

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

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

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

(d) Containers shall be mounted on a substantial support or base secured firmly to the vehicle chassis.

(e) Road clearance shall be as follows:

1. In the case of trailer coaches, when the container support is used inside the frame members, the maximum depth shall not exceed 7 in. from the top of the chassis to provide sufficient road clearance.

2. In the case of a commercial vehicle, the system shall be installed with as much road clearance as possible and never less than the minimum road clearance of the vehicle under maximum spring deflection.

6.9. Piping, Tubing and Fittings.

(a) Regulators shall be of lightweight construction and connected directly to the cylinder valve inlet, or mounted securely by means of a support bracket and connected to the cylinder valve or valves with an approved high pressure flexible connection.

(b) An expansion loop in the gas service piping or an approved flexible connection between the regulator outlet and the gas service piping, shall be used.

(c) Piping, tubing and fittings shall meet the specifications in B.7(a) and (c) except that aluminum tubing is prohibited. Steel pipe or tubing shall have a minimum wall thickness of 0.049 inches and shall be adequately protected against exterior corrosion. For trailer coaches, only seamless drawn copper tubing having an outside diameter not less than ⅜ in. and a wall thickness of not less than 0.032 inch, shall be used for gas service lines.

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

(e) The fuel 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 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 below 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.

6.10. Appliances.

as to design, construction, and performance for their intended use, trailer coach or cargo heating, certified as follows:

(a) All gas consuming appliances shall have their correctness

1. Determined by a nationally recognized testing agency adequately equipped and competent to perform such services and shall be evidenced by the attachment of its seal or label to such gas appliances. This agency shall be one which maintains a program of national inspection of production models of gas appliances at least once each year on the manufacturer's premises. Approval by the American Gas Association Laboratories, as evidenced by the attachment of its Listing Symbol or Approval Seal to gas appliances and a certificate or letter certifying approval under the above-mentioned requirements, or listing by Underwriters' Laboratories, Inc., shall be considered as constituting compliance with the provisions of this section, or

2. Approval by the enforcing authority having jurisdiction.

(b) In the case of trailer coaches, all gas-fired space heaters and water heaters shall be of the full vented type, vented to the outside of the vehicle. Air for combustion shall come from the outside of the trailer. In the case of commercial vehicles which do not contain living quarters and the gas-fired space heater is used to protect the cargo, such space heating equipment may be of the unvented type, but provision shall be made to dispose of the products of combustion to the outside.

(c) Provisions shall be made to insure an adequate supply of air for combustion.

(d) All gas-fired space heaters and water heaters shall be equipped with an approved 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.

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

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

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

6.11. General Precautions.

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

(b) Retests shall be made with properly approved* equipment, and the containers shall be stamped with the date of retest. This is the responsibility of the owner of the containers.

(c) No container shall be charged with fuel unless it bears the proper markings of the code under which it was fabricated, and, in addition with its water capacity and the tare weight of the container in pounds.

(d) No I.C.C. container shall be recharged which has been involved in a fire until it has been requalified for service according to I.C.C. Regulations.

(e) No ASME or API-ASME container shall be recharged which has been involved in a fire until it has been retested in accordance with the requirements for its original hydrostatic test and found to be suitable for continued service.

(f) No container shall be charged without the consent of the owner thereof.

(g) A permanent caution plate shall be provided on the outside of the system enclosure and adjacent to the consuming appliances on trailer coaches. It shall include the following items:

WARNING.

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 when checking for leaks.
4. Container shut-off valves of trailer coach systems shall be closed when the vehicle is in transit.

6.12. Charging of Containers.

(a) Containers shall be charged in accordance with B.17(a) and one of the following:

1. At a properly equipped container charging plant which complies with all applicable requirements of these standards. Such a charging plant and storage containers shall be enclosed by a suitable fence (so called "manproof") which shall have the gates locked when the plant is unattended.
2. At a trailer coach location directly from a tank truck into the container or containers installed at any one trailer coach with the following limitations. No vapor or liquid shall be vented to the atmosphere. The container charging operation shall be performed only by qualified personnel. When containers are accumulated at the tank truck for charging such charging shall not be done within 50 feet of the nearest building, trailer, 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.

*Bureau of Explosives—Association of American Railroads, 30 Vesey St., New York, N. Y.

DIVISION VII.
LIQUEFIED PETROLEUM GAS SERVICE STATIONS

Division VII 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.

7.1. Design Working Pressure and Classification of Storage Containers.

Storage containers shall be designed and classified as follows:

Container Type	For Gases with Vapor Press. Not to Exceed lb. per sq. in. gauge at 100[b] F.	Minimum Design Working Pressure of Container lb. per sq. in. gauge 1949 and earlier edition of ASME Code; Par. U-68, U-69	Minimum Design Working Pressure of Container lb. per sq. in. gauge 1949 edition of ASME Code; Par. U-200, U-201; 1950 and 1952 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 working 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 working 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 and 1952 editions of the ASME Code, and (3) all editions of the API-ASME Code.

7.2. Container Valves and Accessories.

(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 shut-off valve, in conjunction with either:
   (a) An internal back-presure 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 shut-off 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 7.2(a).
2. Safety relief connections as provided in B.6(b).
3. Liquid level gauging devices as provided in B.6(d), B.17(d) and (i).
4. Pressure gauge connections as provided in B.6(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 gauging devices.
3. Pressure gauges.

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

7.3. 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 to a point at least seven feet above the container in such a manner as to prevent any impingement of escaping gas upon the container; loose fitting raincaps shall be