

for LP-Gas vaporizers, either of the indirect type or direct-fired type, shall comply with 5.21.9(A) through 5.21.9(C).

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

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

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

Chapter 6 Installation of LP-Gas Systems

6.1 Scope.

6.1.1* Application. This chapter shall apply to the following:

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

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

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

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

6.2 Location of Containers.

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

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

- (1) Cylinders as specifically provided for in Section 6.19
- (2) Containers of less than 125 gal (0.5 m³) water capacity for the purposes of being filled in buildings or structures complying with Chapter 10
- (3) Containers on LP-Gas vehicles complying with, and parked or garaged in accordance with, Chapter 9
- (4) Containers used with LP-Gas portable engine fuel systems shall comply with 11.15.1
- (5) Containers used with LP-Gas stationary engine fuel systems shall comply with 11.15.2

- (6) Containers used with LP-Gas-fueled industrial trucks complying with 11.13.4
- (7) Containers on LP-Gas-fueled vehicles garaged in accordance with Section 11.16
- (8) Cylinders awaiting use, resale, or exchange when stored in accordance with Chapter 8

6.3 Container Separation Distances.

6.3.1* Containers installed outside of buildings, whether of the portable type replaced on a cylinder exchange basis or permanently installed and refilled at the installation, shall be located with respect to the adjacent containers, important building, group of buildings, or line of adjoining property that can be built upon, in accordance with Table 6.3.1, Table 6.4.2, Table 6.4.5.8, and 6.3.2 through 6.3.11.

6.3.2 When the provisions of 6.26.3 through 6.26.5 are met, the minimum distance from an ASME container to a building shall be reduced by one-half for ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity.

6.3.3 The 25 ft (7.6 m) minimum distance from aboveground ASME containers of 501 gal through 2000 gal (1.9 m³ through 7.6 m³) water capacity to buildings, a group of buildings, or the line of adjoining property that can be built upon shall be reduced to 10 ft (3 m) for a single ASME container of 1200 gal (4.5 m³) or less water capacity where such container is at least 25 ft (7.6 m) from any other LP-Gas container of more than 125 gal (0.5 m³) water capacity.

6.3.4 Minimum distances for underground or mounded ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity incorporating all the provisions of Section 6.26 shall be reduced to 10 ft (3 m).

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

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

6.3.5 The minimum separation distances specified in Table 6.3.1 between containers and buildings of other than wood-frame construction devoted exclusively to gas manufacturing and distribution operations shall be reduced to 10 ft (3 m).

6.3.6 If the aggregate water capacity of a multicontainer installation is 501 gal (1.9 m³) or more and the installation is comprised of individual containers, each with a water capacity of less than 125 gal (0.5 m³), the minimum distance shall comply with Table 6.3.1 and the following:

- (1) The aggregate capacity shall be used rather than the capacity per container.
- (2) If more than one such installation is made, each installation shall be separated from any other installation by at least 25 ft (7.6 m).
- (3) The minimum distances between containers shall not be applied to installations covered by 6.3.6.

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

6.3.8 The distance measured horizontally from the point of discharge of a container pressure relief valve to any building opening below the level of such discharge shall be in accordance with Table 6.3.8.

Table 6.3.1 Separation Distances Between Containers, Important Buildings, and Line of Adjoining Property That Can Be Built Upon

Water Capacity per Container		Minimum Distances					
		Mounded or Underground Containers ^a		Aboveground Containers ^b		Between Containers ^c	
		ft	m	ft	m	ft	m
gal	m ³						
<125 ^d	<0.5 ^d	10	3	0 ^e	0 ^e	0	0
125-250	0.5-1.0	10	3	10	3	0	0
251-500	>1.0-1.9	10	3	10	3	3	1
501-2,000	>1.9-7.6	10	3	25 ^f	7.6	3	1
2,001-30,000	>7.6-114	50	15	50	15	5	1.5
30,001-70,000	>114-265	50	15	75	23		
70,001-90,000	>265-341	50	15	100	30		
90,001-120,000	>341-454	50	15	125	38	¼ of sum of diameters of adjacent containers	
120,001-200,000	>454-757	50	15	200	61		
200,001-1,000,000	>757-3785	50	15	300	91		
>1,000,000	>3785	50	15	400	122		

^a See 6.3.4.^b See 6.3.11.^c See 6.3.10.^d See 6.3.9.^e See 6.3.7 and 6.3.8.^f See 6.3.3.

Table 6.3.8 Separation Distance Between Container Pressure Relief Valve and Building Openings

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

6.3.9 The distance measured in any direction from the point of discharge of a container pressure relief valve, vent of a fixed maximum liquid level gauge on a container, and the container filling connection to exterior sources of ignition, openings into direct-vent (sealed combustion system) appliances,

and mechanical ventilation air intakes shall be in accordance with Table 6.3.8.

6.3.10 Access at the ends or sides of individual underground containers having a water capacity of 125 gal (0.5 m³) or more shall be provided in multicontainer installations to facilitate working with cranes or hoists.

6.3.11 The horizontal distance between the portion of a building that overhangs out of the building wall and an ASME container of 125 gal. (0.5 m³) or more water capacity shall comply with the following:

- (1) The horizontal distance shall be measured from a point determined by projecting the outside edge of the overhanging structure vertically downward to grade or other level upon which the container is installed.
- (2) The horizontal distance specified in 6.3.11(1) shall be at least 50 percent of the separation distance required in Table 6.3.1.
- (3) The horizontal distance requirement shall apply only when the overhang extends more than 5 ft (1.5 m) from the building.
- (4) The horizontal distance requirement shall not apply when the overhanging structure is 50 ft (15 m) or more above the relief valve discharge outlet.
- (5) The horizontal distance requirement shall not apply to ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity where the container distance from a building is in accordance with 6.26.2.

6.4 Other Container Location Requirements.

6.4.1 Where storage containers having an aggregate water capacity of more than 4000 gal (15.1 m³) are located in heavily populated or congested areas, the siting provisions of 6.3.1 and Table 6.3.1 shall be permitted to be modified as indicated by the fire safety analysis described in 6.25.3.

6.3.2

6.24.4 Installation of Vehicle Fuel Dispensers.

6.24.4.1 Hose shall comply with the following:

- (1) Hose length shall not exceed 18 ft (5.5 m) unless approved by the authority having jurisdiction.
- (2) All hose shall be listed.
- (3) When not in use, hose shall be secured to protect them from damage.

6.24.4.2 A listed emergency breakaway device complying with ANSI/UL 567, *Standard Pipe Connectors for Flammable and Combustible Liquids and LP-Gas*, and designed to retain liquid on both sides of the breakaway point, or other devices affording equivalent protection approved by the authority having jurisdiction, shall be installed.

6.24.4.3 Dispensing devices for LP-Gas shall be located as follows:

- (1) Conventional systems shall be at least 10 ft (3.0 m) from any dispensing device for Class I liquids.
- (2) Low-emission transfer systems in accordance with Section 6.26 shall be at least 5 ft (1.5 m) from any dispensing device for Class I liquids.

6.25 Fire Protection.

6.25.1 **Application.** Section 6.25 applies to fire protection for industrial plants, bulk plants, and dispensing stations.

6.25.2* Planning.

6.25.2.1 The planning for the response to incidents including the inadvertent release of LP-Gas, fire, or security breach shall be coordinated with local emergency response agencies.

6.25.2.2 Planning shall include consideration of the safety of emergency personnel, workers, and the public.

6.25.3* Protection of ASME Containers.

6.25.3.1 Fire protection shall be provided for installations with an aggregate water capacity of more than 4000 gal (15.1 m³) and for ASME containers on roofs.

6.25.3.2 The modes of fire protection shall be specified in a written fire safety analysis for new installations, and for existing installations that have an aggregate water capacity of more than 4000 gal (15.1 m³), and for ASME containers on roofs. Existing installation shall comply with this requirement within 2 years of the effective date of this code.

6.25.3.3 The fire safety analysis shall be submitted by the owner, operator, or their designee, to the authority having jurisdiction and local emergency responders.

6.25.3.4 The fire safety analysis shall be updated when the storage capacity or transfer system is modified.

6.25.3.5 The fire safety analysis shall be an evaluation of the total product control system, such as the emergency shutoff and internal valves equipped for remote closure and automatic shutoff using thermal (fire) actuation, pullaway protection where installed, and the optional requirements of Section 6.26.

6.25.3.6 If in the preparation for the fire safety analysis it is determined that a hazard to adjacent structures exists that exceeds the protection provided by the provisions of this code, special protection shall be provided in accordance with 6.25.5.

6.25.4 Other Protection Requirements.

6.25.4.1 Roadways or other means of access for emergency equipment, such as fire department apparatus, shall be provided.

6.25.4.2 Each industrial plant, bulk plant, and distributing point shall be provided with at least one approved portable fire extinguisher having a minimum capacity of 18 lb (8.2 kg) of dry chemical with a B:C rating. Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

6.25.4.3* LP-Gas fires shall not be extinguished until the source of the burning gas has been shut off.

6.25.4.4 Emergency controls shall be conspicuously marked, and the controls shall be located so as to be readily accessible in emergencies.

6.25.5 Special Protection.

6.25.5.1* If insulation is used, it shall be capable of limiting the container temperature to not over 800°F (427°C) for a minimum of 50 minutes as determined by test, with insulation applied to a steel plate and subjected to a test flame applied substantially over the area of the test plate.

6.25.5.2 The insulation system shall be inherently resistant to weathering and the action of hose streams.

6.25.5.3 If mounding is utilized, the provisions of 6.6.6.3 shall be required.

6.25.5.4 If burial is utilized, the provisions of 6.6.6.1 shall be required.

6.25.6 Water Spray Systems.

6.25.6.1 If water spray fixed systems and monitors are used, they shall comply with NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.

6.25.6.2 Where water spray fixed systems and monitors are used, they shall be automatically actuated by fire-responsive devices and shall also have a capability for manual actuation.

6.25.6.3 Where monitor nozzles are used, they shall be located and arranged so that all container surfaces that can be exposed to fire are wetted.

6.26 Alternate Provisions for Installation of ASME Containers.

6.26.1 **Application.** Section 6.26 shall apply to alternate provisions for the location and installation of ASME containers that incorporate the use of redundant fail-safe product control measures and low-emission transfer concepts for the purpose of enhancing safety and to mitigate distance and special protection requirements.

6.26.2 Spacing Requirements for Underground and Mounded ASME Containers.

6.26.2.1 Where all the provisions of Section 6.26 are complied with, the minimum distances from important buildings and the line of adjoining property that can be built upon to underground and mounded ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity shall be reduced to 10 ft (3.0 m).

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

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

6.26.3 **ASME Container Appurtenances.** The provisions in 6.26.3.1 through 6.26.3.5 shall be required for ASME contain-

ers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity referenced in Section 6.26.

6.26.3.1 All liquid withdrawal openings and all vapor withdrawal openings that are 1¼ in. (32 mm) or larger shall be equipped with an internal valve.

6.26.3.2 The internal valves shall remain closed except during periods of operation.

6.26.3.3 Internal valves shall be equipped for remote closure and automatic shutoff through thermal (fire) actuation.

6.26.3.4 A positive manual shutoff valve shall be installed as close as practical to each internal valve.

6.26.3.5 All liquid and vapor inlet openings shall be equipped in accordance with 6.26.3.1 through 6.26.3.4 or shall be equipped with a backflow check valve that is designed for the intended application and a positive manual shutoff valve installed as close as practical to the backflow check valve.

6.26.4 Redundant Fail-Safe Product Control.

6.26.4.1 At cargo tank vehicle and railroad tank car transfer points, protection shall be provided in accordance with Section 6.12 using approved emergency shutoff valves or backflow check valves or a combination of the two.

6.26.4.2 Automatic system shutdown of all primary valves (internal valves and emergency shutoff valves) shall be provided through thermal (fire) actuation and in the event of a hose pull-away.

6.26.4.3 Remote shutdown capability, including power supply for the transfer equipment and all primary valves (internal and emergency shutoff), shall be provided.

(A) A remote shutdown station shall be installed within 15 ft (4.6 m) of the point of transfer.

(B) At least one additional remote shutdown station shall be installed not less than 25 ft (7.6 m), or more than 100 ft (30.5 m), from the transfer point.

(C) Emergency remote shutdown stations shall be identified as such by a sign incorporating the words "Propane" and "Emergency Shutoff" in block letters not less than 2 in. (5.1 cm) in height on a background of contrasting color to the letters. The sign shall be visible from the point of transfer.

6.26.5 Low Emission Transfer. The transfer distance requirements of Table 6.5.3 and 6.24.4.3 shall be reduced by one-half where the installation is in accordance with 6.26.5. The transfer site shall be identified as "Low Emission Transfer Site" by having a sign or other marking posted in the area.

6.26.5.1 Transfer into permanently mounted ASME engine fuel containers on vehicles shall meet the provisions of 6.26.5.1(A) through 6.26.5.1(D).

(A) The delivery valve and nozzle combination shall mate with the filler valve in the receiving container in such a manner that, when they are uncoupled following a transfer of product, not more than 0.24 in.³ (4 cm³) of product (liquid equivalent) is released to the atmosphere.

(B) Fixed maximum liquid level gauges that are installed on engine fuel and mobile containers in accordance with Table 5.7.4.1 shall not be used to determine the maximum permitted filling limit at a low emission transfer site.

(C) The maximum permitted filling limit shall be in accordance with Section 11.5 and shall be determined by an overfilling prevention device or other approved means.

(D) A label shall be placed near the fixed maximum liquid level gauge providing the following instructions: "Do not use this fixed maximum liquid level gauge at low emission transfer stations."

6.26.5.2 Transfer into stationary ASME containers shall meet the provisions of 6.26.5.2(A) through 6.26.5.2(F).

(A) Where transfer is made through a hose of nominal 1 in. (25 mm) size or smaller, the delivery valve and nozzle combination shall not contain an interstitial volume greater than 0.24 in.³ (4 cm³).

(B) Where transfer is made through hose larger than 1 in. (25 mm) nominal size, no more than 0.91 in.³ (15 cm³) of LP-Gas (liquid equivalent) shall be released to the atmosphere during the transfer operation, including the uncoupling of the transfer hose.

(C) Fixed maximum liquid level gauges on low emission transfer systems shall be installed and used to verify the (function) accuracy of liquid level gauges or other liquid level gauging devices.

(D) Fixed maximum liquid level gauges shall not be used in the routine filling of low emission transfer systems.

(E) The use of a float gauge or other approved nonventing device for containers of 2001 gal (7.6 m³) or larger water capacity shall be the only means for determining the maximum filling limit.

(F) The maximum filling limit for containers of less than 2001 gal (7.6 m³) water capacity in low emission transfer systems shall be controlled through the use of an overfilling prevention device or other device approved for this service.

Chapter 7 LP-Gas Liquid Transfer

7.1* Scope.

7.1.1 This chapter applies to transfers of liquid LP-Gas from one container to another wherever this transfer involves connections and disconnections in the transfer system or the venting of LP-Gas to the atmosphere.

7.1.2 This chapter also applies to operational safety and methods for determining the quantity of LP-Gas permitted in containers.

7.2 Operational Safety.

7.2.1 Transfer Personnel.

7.2.1.1 Transfer operations shall be conducted by qualified personnel meeting the provisions of Section 4.4.

7.2.1.2 At least one qualified person shall remain in attendance at the transfer operation from the time connections are made until the transfer is completed, shutoff valves are closed, and lines are disconnected.

7.2.1.3 Transfer personnel shall exercise caution to ensure that the LP-Gases transferred are those for which the transfer system and the containers to be filled are designed.