

WAC 296-24-47505 Basic rules. (1) Odorizing gases.

(a) You must effectively odorize all liquefied petroleum gases by an approved agent of such character as to indicate positively, by distinct odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of flammability. Odorization, however, is not required if harmful in the use of 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.

(b) The odorization requirement of (a) of this subsection will be considered to be met by the use of 1.0 pounds of ethyl mercaptan, 1.0 pounds of thiophane or 1.4 pounds of amyl mercaptan per 10,000 gallons of LP-gas. However, this listing of odorants and quantities must not exclude the use of other odorants that meet the odorization requirements of (a) of this subsection.

(2) Approval of equipment and systems.

(a) Each system utilizing DOT containers in accordance with 49 C.F.R. Part 178 must have its container valves, connectors, manifold valve assemblies, and regulators approved.

(b) Each system for domestic or commercial use utilizing containers of two thousand gallons or less water capacity, other than those constructed in accordance with 49 C.F.R. Part 178, must consist of a container assembly and one or more regulators, and may include other parts. You must individually list the system as a unit or the container assembly as a unit, and the regulator or regulators.

(c) In systems utilizing containers of over two thousand gallons water capacity, each regulator, container, valve, excess flow valve, gaging device, and relief valve installed on or at the container, must have its correctness as to design, construction, and performance determined by listing by a nationally recognized testing laboratory. Refer to federal regulation 29 C.F.R. 1910.7 for definition of nationally recognized testing laboratory.

(d) You must not construe the provisions of subsection (3)(a) of this section as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the standard for the Storage and Handling of Liquefied Petroleum Gases NFPA No. 58 in effect at the time of fabrication.

(e) Containers used with systems embodied in this section and WAC 296-24-47509 (3)(c) and 296-24-47513, must be constructed, tested, and stamped in accordance with DOT specifications effective at the date of their manufacture.

(3) Requirements for construction and original test of containers.

(a) You must design, construct, and test containers used with systems embodied in WAC 296-24-47509, 296-24-47513 through 296-24-47517, except as provided in WAC 296-24-47511 (3)(c), in accordance with the Rules for Construction of Unfired Pressure Vessels, section VIII, Division 1, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1968 edition.

(b) Containers constructed according to the 1949 and earlier editions of the ASME Code do not have to comply with U-2 through U-10 and U-19 thereof. Containers constructed according to U-70 in the 1949 and earlier editions do not meet the requirements of this section.

(c) Containers designed, constructed, and tested prior to July 1, 1961, according to the Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, 1951 edition with 1954 Addenda, of the American Petroleum Institute and the American Society of Mechanical Engineers will be considered in conformance. Containers constructed according to

API-ASME Code do not have to comply with section I or with appendix to section I. W-601 to W-606 inclusive in the 1943 and earlier editions do not apply.

(4) Welding of containers.

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

(b) Where repair or modification involving welding of DOT containers is required, you must return the container to a qualified manufacturer making containers of the same type, and the repair or modification made in compliance with DOT regulations.

(5) Markings on container.

(a) You must mark each container covered in subsection (3)(a) of this section except as provided in subsection (2)(d) of this section as specified in the following:

(i) With a marking identifying compliance with, and other markings required by, the rules of the reference under which the container is constructed; or with the stamp and other markings required by the laws, rules or regulations as administered by the state of Washington, department of labor and industries pertaining to such containers.

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

(iii) With the name and address of the supplier of the container, or with the trade name of the container.

(iv) With the water capacity of the container in pounds or gallons, United States standard.

(v) With the pressure in p.s.i.g., for which the container is designed.

(vi) With the wording "This container must not contain a product having a vapor pressure in excess of—p.s.i.g. at 100°F," see WAC 296-24-47509, Table H-31.

(vii) With the tare weight in pounds or other identified unit of weight for containers with a water capacity of three hundred pounds or less.

(viii) 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 must be increments of not more than 20°F. This marking may be located on the liquid level gaging device.

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

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

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

(6) Location of containers and regulating equipment.

(a) You must locate containers, and first stage regulating equipment if used, outside of buildings, except under one or more of the following:

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

(ii) When portable use is necessary and in accordance with WAC 296-24-47507(5).

(iii) LP-gas fueled stationary or portable engines in accordance with WAC 296-24-47511 (11) or (12).

(iv) LP-gas fueled industrial trucks used in accordance with WAC 296-24-47511(13).

(v) LP-gas fueled vehicles garaged in accordance with WAC 296-24-47511(14).

(vi) Containers awaiting use or resale when stored in accordance with WAC 296-24-47513.

(b) You must locate each individual container with respect to the nearest important building or group of buildings or line of adjoining property which may be built on in accordance with Table H-23.

TABLE H-23

Water capacity per container	Minimum distances		
	Containers		Between above-ground containers
	Under-ground	Above-ground	
Less than 125 gals ¹	10 feet	None	None
125 to 250 gallons	10 feet	10 feet	None.
251 to 500 gallons	10 feet	10 feet	3 feet.
501 to 2,000 gallons	25 feet ²	25 feet ²	3 feet.
2,001 to 30,000 gallons	50 feet	50 feet	5 feet.
30,001 to 70,000 gallons	50 feet	75 feet	1/4 of sum diameters of adjacent containers.
70,001 to 90,000 gallons	50 feet	100 feet	

¹ If the aggregate water capacity of a multicontainer installation at a consumer site is five hundred one gallons or greater, the minimum distance must comply with the appropriate portion of this table, applying the aggregate capacity rather than the capacity per container. If more than one installation is made, each installation must be separated from another installation by at least twenty-five feet. Do not apply the MINIMUM DISTANCES BETWEEN ABOVE-GROUND CONTAINERS to such installations.

²Note: The above distance requirements may be reduced to not less than ten feet for a single container of one thousand two hundred gallons water capacity or less, providing such a container is at least twenty-five feet from any other LP-gas container of more than one hundred twenty-five gallons water capacity.

(c) You must not stack containers installed for use one above the other.

(d) In industrial installations involving containers of one hundred eighty thousand gallons aggregate water capacity or more, where serious mutual exposures between the container and adjacent properties prevail, firewalls or other means of special protection designed and constructed in accordance with good engineering practices are required.

(e) In the case of buildings devoted exclusively to gas manufacturing and distributing operations, the distances required by Table H-23 may be reduced provided that in no case you locate containers of water capacity exceeding 500 gallons be located closer than 10 feet to such gas manufacturing and distributing buildings.

(f) You must remove readily ignitable material such as weeds and long dry grass within 10 feet of any container.

(g) The minimum separation between liquefied petroleum gas containers and flammable liquid tanks must be 20 feet, and the minimum separation between a container and the centerline of the dike must be 10 feet. The foregoing provision must not apply when LP-gas containers of 125 gallons or less capacity are installed adjacent to Category 4 flammable liquid tanks of 275 gallons or less capacity.

(h) You must take suitable means to prevent the accumulation of flammable liquids under adjacent liquefied petroleum gas containers, such as by diking, diversion curbs, or grading.

(i) When dikes are used with flammable liquid tanks, you must not locate any liquefied petroleum gas containers within the diked area.

(7) Container valves and container accessories.

(a) Valves, fittings, and accessories connected directly to the container including primary shutoff valves, must have a rated working pressure of at least 250 p.s.i.g. and must be of material and design suitable for LP-gas service. You must not use cast iron for container valves, fittings, and accessories. This does not prohibit the use of container valves made of malleable or nodular iron.

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

(c) Excess flow valves, where required must 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 must have a greater capacity than the rated flow of the excess flow valve.

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

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

(f) Except as provided in WAC 296-24-47507 (5)(a)(ii), you must locate excess flow and back pressure check valves where required by this section inside of the container or at a point outside where the line enters the container; in the latter case, you must install 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.

(g) You must design excess flow valves with a bypass, not to exceed a No. 60 drill size opening to allow equalization of pressures.

(h) You must equip containers of more than 30 gallons water capacity and less than two thousand gallons water capacity, filled on a volumetric basis, and manufactured after December 1, 1963, for filling into the vapor space.

(8) Piping—Including pipe, tubing, and fittings.

(a) Pipe, except as provided in WAC 296-24-47511 (6)(a) must be wrought iron or steel (black or galvanized), brass, copper, or aluminum alloy. Aluminum alloy pipe must be at least Schedule 40 in accordance with the specifications for Aluminum Alloy Pipe, American National Standards Institute (ANSI) H38.7-1969 (ASTM, B241-1969), except that the use of alloy 5456 is prohibited and must be suitably marked at each end of each length indicating compliance with American National Standard Institute specifications. You must protect aluminum alloy pipe against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by such liquids as water (except rain water), detergents, sewage, or leaking from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum nominal pipe size for aluminum pipe must be 3/4 inch and must not be used for pressures exceeding 20 p.s.i.g. You must not install aluminum alloy pipe within 6 inches of the ground.

(i) Vapor piping with operating pressures not exceeding 125 p.s.i.g. must be suitable for a working pressure of at least 125 p.s.i.g. Pipe must be at least Schedule 40 ASTM A-53-69, Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal.

(ii) Vapor piping with operating pressures over 125 p.s.i.g. and all liquid piping must be suitable for a working pressure of at least 250 p.s.i.g. Pipe must be at least Schedule 80 if joints are threaded or threaded and back welded. You must use at least Schedule 40 (ASTM A-53-1969 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal) if joints are welded, or welded and flanged.

(b) Tubing must be seamless and of copper, brass, steel, or aluminum alloy. Copper tubing must be of Type K or L or equivalent as covered in the Specification for Seamless Copper Water Tube, ANSI H23.1-1970 (ASTM B88-1969). Aluminum alloy tubing must be of Type A or B or equivalent as covered in Specification ASTM B210-1968 and must be suitably marked every eighteen inches indicating compliance with ASTM specifications. The minimum nominal wall thickness of copper tubing and aluminum alloy tubing must be as specified in Table H-24 and Table H-25.

TABLE H-24

WALL THICKNESS OF COPPER TUBING¹

Note: The standard size by which tube is designated is one-eighth-inch smaller than its nominal outside diameter.

Standard size (inches)	Nominal O.D. (inches)	Nominal wall thickness (inches)	
		Type K	Type L
1/4	0.375	0.035	0.030
3/8	0.500	0.049	0.035
1/2	0.625	0.049	0.040
5/8	0.750	0.049	0.042
3/4	0.875	0.065	0.045
1	1.125	0.065	0.050
1 1/4	1.375	0.065	0.055
1 1/2	1.625	0.072	0.060
2	2.125	0.083	0.070

¹ Based on data in Specification for Seamless Copper Water Tubing, ANSI H23.1-1970 (ASTM B-88-69).

TABLE H-25

WALL THICKNESS OF ALUMINUM ALLOY TUBING¹

Outside diameter (inches)	Nominal wall thickness (inches)	
	Type A	Type B
3/8	0.035	0.049
1/2	0.035	0.049
5/8	0.042	0.049
3/4	0.049	0.058

¹ Based on data in Standard Specification for Aluminum-Alloy Drawn Seamless Coiled Tubes for Special Purpose Applications, ASTM B210-68.

You must protect aluminum alloy tubing against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by liquids such as water (except rainwater), detergents, sewage, or leakage from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum outside diameter for aluminum alloy tubing must be 3/4 inch and must not be used for pressures exceeding 20 p.s.i.g. You must not install aluminum alloy tubing within six inches of the ground.

(c) In systems where the gas in liquid form without pressure reduction enters the building, you must use 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 three sixty-fourths inch. This requirement does 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, nor to buildings, structures, or equipment under construction or undergoing major renovation.

(d) Pipe joints may be screwed, flanged, welded, soldered, or brazed with a material having a melting point exceeding 1,000°F. Joints on seamless copper, brass, steel, or aluminum alloy gas tubing must be made by means of approved gas tubing fittings, or soldered or brazed with a material having a melting point exceeding 1,000°F.

(e) For operating pressures of 125 p.s.i.g. or less, fittings must be designed for a pressure of at least 125 p.s.i.g. For operating pressures above 125 p.s.i.g., fittings must be designed for a minimum of 250 p.s.i.g.

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

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

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

(i) You must test all piping, tubing, or hose after assembly and proved free from leaks at not less than normal operating pressures. After installation, you must test piping and tubing of all domestic and commercial systems and prove it to be free of leaks using a manom-

eter or equivalent device that will indicate a drop in pressure. Test must not be made with a flame.

(j) You must make provisions to compensate for expansion, contraction, jarring, and vibration, and for settling. This may be accomplished by flexible connections.

(k) Piping outside buildings may be buried, above ground, or both, but must be well supported and protected against physical damage. Where soil conditions warrant, you must protect all piping against corrosion. Where condensation may occur, you must pitch the piping back to the container, or provide suitable means for revaporization of the condensate.

(9) **Hose specifications.**

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

(b) You must mark any hose subject to container pressure "LP-gas" or "LPG" at not greater than ten-foot intervals.

(c) Hose subject to container pressure must be designed for a bursting pressure of not less than 1,250 p.s.i.g.

(d) Hose subject to container pressure must have its correctness as to design construction and performance determined by being listed (see WAC 296-24-47501(15)).

(e) Hose connections subject to container pressure must be capable of withstanding, without leakage, a test pressure of not less than 500 p.s.i.g.

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

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

(i) The appliances connected with hose must be portable and need a flexible connection.

(ii) For use inside buildings the hose must be of minimum practical length, but must not exceed 6 feet except as provided in WAC 296-24-47507 (5)(a)(vii) and must not extend from one room to another, nor pass through any walls, partitions, ceilings, or floors. You must not conceal such hose from view or used in a concealed location. For use outside of buildings, the hose may exceed this length but you must keep it as short as practical.

(iii) The hose must be approved and you must not use it where it is likely to be subjected to temperatures above 125°F. You must securely connect the hose to the appliance and you must not permit the use of rubber slip ends.

(iv) The shutoff valve for an appliance connected by hose must be in the metal pipe or tubing and not at the appliance end of the hose. When shutoff valves are installed close to each other, you must take precautions to prevent operation of the wrong valve.

(v) You must protect hose used for connecting to wall outlets from physical damage.

(10) **Safety devices.**

(a) You must provide every container except those constructed in accordance with DOT specifications and every vaporizer (except motor fuel vaporizers and except vaporizers described in subsection

(11)(b)(iii) of this section and WAC 296-24-47509 (4)(e)(i)) whether heated by artificial means or not, with one or more safety relief valves of spring-loaded or equivalent type. You must arrange these valves to afford free vent to the outer air with discharge not less than five feet horizontally away from any opening into the building which is below such discharge. The rate of discharge must be in accordance with the requirements of (b) or (d) of this subsection in the case of vaporizers.

(b) Minimum required rate of discharge in cubic feet per minute of air at 120% of the maximum permitted start to discharge pressure for safety relief valves to be used on containers other than those constructed in accordance with DOT specification must be as follows:

Surface area (sq. ft.)	Flow rate CFM air
20 or less	626
25	751
30	872
35	990
40	1,100
45	1,220
50	1,330
55	1,430
60	1,540
65	1,640
70	1,750
75	1,850
80	1,950
85	2,050
90	2,150
95	2,240
100	2,340
105	2,440
110	2,530
115	2,630
120	2,720
125	2,810
130	2,900
135	2,990
140	3,080
145	3,170
150	3,260
155	3,350
160	3,440
165	3,530
170	3,620
175	3,700
180	3,790
185	3,880
190	3,960
195	4,050
200	4,130
210	4,300
220	4,470
230	4,630
240	4,800

Surface area (sq. ft.)	Flow rate CFM air
250	4,960
260	5,130
270	5,290
280	5,450
290	5,610
300	5,760
310	5,920
320	6,080
330	6,230
340	6,390
350	6,540
360	6,690
370	6,840
380	7,000
390	7,150
400	7,300
450	8,040
500	8,760
550	9,470
600	10,170
650	10,860
700	11,550
750	12,220
800	12,880
850	13,540
900	14,190
950	14,830
1,000	15,470
1,050	16,100
1,100	16,720
1,150	17,350
1,200	17,960
1,250	18,570
1,300	19,180
1,350	19,780
1,400	20,380
1,450	20,980
1,500	21,570
1,550	22,160
1,600	22,740
1,650	23,320
1,700	23,900
1,750	24,470
1,800	25,050
1,850	25,620
1,900	26,180
1,950	26,750
2,000	27,310

Surface area = total outside surface area of container in square feet.

(c) When the surface area is not stamped on the nameplate or when the marking is not legible, the area can be calculated by using one of the following formulas:

(i) Cylindrical container with hemispherical heads:

Area = Overall length x outside diameter x 3.1416.

(ii) Cylindrical container with other than hemispherical heads:

Area = (Overall length + 0.3 outside diameter) x outside diameter x 3.1416.

Note: This formula is not exact, but will give results within the limits of practical accuracy for the sole purpose of sizing relief valves.

(iii) Spherical container:

Area = Outside diameter squared x 3.1416.

Flow rate-CFM air = Required flow capacity in cubic feet per minute of air at standard conditions, 60°F and atmospheric pressure (14.7 p.s.i.a.).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than two thousand square feet, the required flow rate can be calculated using the formula, flow rate-CFM air = 53.632 A^{0.82}.

A = Total outside surface area of the container in square feet.

Valves not marked "air" have flow rate marking in cubic feet per minute of liquefied petroleum gas. These can be converted to ratings in cubic feet per minute of air by multiplying the liquefied petroleum gas ratings by factors listed below. Air flow ratings can be converted to ratings in cubic feet per minute of liquefied petroleum gas by dividing the air ratings by the factors listed below.

AIR CONVERSION FACTORS

Container type.....	100	125	150	175	200
Air conversion factor...	1.162	1.142	1.113	1.078	1.010

(d) Minimum required rate of discharge for safety relief valves for liquefied petroleum gas vaporizers (steam heated, water heated, and direct fired).

You must determine the minimum required rate of discharge for safety relief valves as follows:

(i) Obtain the total surface area by adding the surface area of vaporizer shell in square feet directly in contact with LP-gas and the heat exchanged surface area in square feet directly in contact with LP-gas.

(ii) Obtain the minimum required rate of discharge in cubic feet of air per minute, at 60°F and 14.7 p.s.i.a. from (b) of this subsection, for this total surface area.

(e) You must set container and vaporizer safety relief valves to start-to-discharge, with relation to the design pressure of the container, in accordance with Table H-26.

TABLE H-26

Containers	Minimum (%)	Maximum (%)
ASME Code; Par. U-68, U-69—1949 and earlier editions	110	¹ 125
ASME Code; Par. U-200, U-201—1949 edition	88	¹ 100

Containers	Minimum (%)	Maximum (%)
ASME Code—1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division I) editions	88	¹ 100
API—ASME Code— all editions	88	¹ 100
DOT—As prescribed in 49 C.F.R. Chapter I		

¹ Manufacturers of safety relief valves are allowed a plus tolerance not exceeding 10% of the set pressure marked on the valve.

(f) Safety relief devices used with systems employing containers other than those constructed according to DOT specifications must be so constructed as to discharge at not less than the rates shown in (b) of this subsection, before the pressure is in excess of 120% of the maximum (not including the 10% referred to in (e) of this subsection) permitted start to discharge pressure setting of the device.

(g) In certain locations sufficiently sustained high temperatures prevail which 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.

(h) You must arrange safety relief valves so that the possibility of tampering will be minimized. If pressure setting or adjustment is external, you must provide the relief valves with approved means for sealing adjustment.

(i) You must not install shutoff valves between the safety relief devices and the container, or the equipment or piping to which the safety relief device is connected except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded.

(j) Safety relief valves must have direct communication with the vapor space of the container at all times.

(k) You must plainly and permanently mark each container safety relief valve used with systems covered by WAC 296-24-47509, 296-24-47511, and 296-24-47517, except as provided in WAC 296-24-47511 (3)(c) with the following: "Container type" of the pressure vessel on which the valve is designed to be installed; the pressure in p.s.i.g. at which the valve is set to discharge; the actual rate of discharge of the valve in cubic feet per minute of air at 60°F and 14.7 p.s.i.a.; and the manufacturer's name and catalog 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.g.; and that its rate of discharge is four thousand fifty cubic feet per minute of air as determined in (b) of this subsection.

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

(m) You must install a hydrostatic relief valve between each pair of shutoff valves on liquefied petroleum gas liquid piping so as to relieve into a safe atmosphere. The start-to-discharge pressure setting of such relief valves must not be in excess of 500 p.s.i.g. The minimum setting on relief valves installed in piping connected to other than DOT containers must not be lower than 140% of the container relief valve setting and in piping connected to DOT containers not

lower than 400 p.s.i.g. Such a relief valve should not be installed in the pump discharge piping if the same protection can be provided by installing the relief valve in the suction piping. The start-to-discharge pressure setting of such a relief valve, if installed on the discharge side of a pump, must be greater than the maximum pressure permitted by the recirculation device in the system.

(n) The discharge from any safety relief device must not terminate in or beneath any building, except relief devices covered by subsection (6)(a)(i) through (vi) of this section, or WAC 296-24-47507 (4)(a) or (5).

(o) You must not locate container safety relief devices and regulator relief vents less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(11) Vaporizer and housing.

(a) You must construct and install indirect fired vaporizers utilizing steam, water, or other heating medium as follows:

(i) You must construct vaporizers in accordance with the requirements of subsection (3)(a) through (c) of this section and you must permanently mark them as follows:

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

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

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

(D) With the name or symbol of the manufacturer.

(ii) Vaporizers having an inside diameter of six inches or less exempted by the ASME Unfired Pressure Vessel Code, Section VIII of the ASME Boiler and Pressure Vessel Code—1968 must have a design pressure not less than 250 p.s.i.g. and need not be permanently marked.

(iii) You must not install heating or cooling coils inside a storage container.

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

When vaporizing and/or mixing equipment is located in a structure or building not used exclusively for gas manufacturing or distribution, either attached to or within such a building, you must separate such structure or room from the remainder of the building by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipe or conduit passing through it. You must provide such structure or room with adequate ventilation and it must have a roof or at least one exterior wall of lightweight construction.

(v) Vaporizers must have, at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with subsection (10)(d) of this section, except as provided in WAC 296-24-47507 (4)(e)(i).

(vi) You must provide the heating medium lines into and leaving the vaporizer with suitable means for preventing the flow of gas into the heat systems in the event of tube rupture in the vaporizer. You must provide vaporizers with suitable automatic means to prevent liquid passing through the vaporizers to the gas discharge piping.

(vii) 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 must be ventilated near the floorline and roof to the outside. You must separate the device location from all compartments or rooms containing liquefied petroleum gas vaporizers, pumps, and central gas mixing devices by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipes or conduit passing through it. This requirement does not apply to the domestic water heaters which may supply heat for a vaporizer in a domestic system.

(viii) You must equip gas-fired heating systems supplying heat exclusively for vaporization purposes with automatic safety devices to shut off the flow of gas to main burners, if the pilot light should fail.

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

(x) You must not equip vaporizers with fusible plugs.

(xi) Vaporizer houses must not have unprotected drains to sewers or sump pits.

(b) You must install atmospheric vaporizers employing heat from the ground or surrounding air as follows:

(i) Buried underground, or

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

(iii) 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 demonstrate that the assembly is safe without safety relief valves.

(c) You must construct, mark, and install direct gas-fired vaporizers as follows:

(i) In accordance with the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code—1968 that are applicable to the maximum working conditions for which the vaporizer is designed.

(ii) 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.

(iii) Vaporizers may be connected to the liquid section or the gas section of the storage container, or both; but in any case there must 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.

(iv) You must locate vaporizers with capacity not exceeding 35 gallons per hour at least 5 feet from container shutoff valves. You must locate vaporizers having capacity of more than 35 gallons but not exceeding 100 gallons per hour at least 10 feet from the container shutoff valves. You must locate vaporizers having a capacity greater than 100 gallons per hour at least 15 feet from container shutoff valves.

(v) Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. Vaporizing housing structures must be of noncombustible construction, well ventilated near the floorline and the

highest point of the roof. When vaporizer and/or mixing equipment is located in a structure or room attached to or within a building, you must separate such structure or room from the remainder of the building by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipes or conduit passing through it. You must provide such structure or room with adequate ventilation, and it must have a roof or at least one exterior wall of lightweight construction.

(vi) Vaporizers must have at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with subsection (10)(d) of this section. You must locate the relief valve so as not to be subjected to temperatures in excess of 140°F.

(vii) You must provide vaporizers with suitable automatic means to prevent liquid passing from the vaporizer to the gas discharge piping of the vaporizer.

(viii) You must provide vaporizers with means for manually turning off the gas to the main burner and pilot.

(ix) You must equip vaporizers with automatic safety devices to shut off the flow of gas to main burners if the pilot light should fail. When the flow through the pilot exceeds 2,000 B.T.U. per hour, you must also equip the pilot with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(x) You must separate pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired vaporizer from the open flame by a substantially airtight noncombustible partition or partitions.

(xi) Except as provided in (c)(v) of this subsection, you must maintain the following minimum distances between direct fired vaporizers and the nearest important building or group of buildings or line of adjoining property which may be built upon:

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

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

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

(xii) Direct fired vaporizers must not raise the product pressure above the design pressure of the vaporizer equipment nor must they raise the product pressure within the storage container above the pressure shown in the second column of Table H-31. (See WAC 296-24-47509.)

(xiii) You must not provide vaporizers with fusible plugs.

(xiv) Vaporizers must not have unprotected drains to sewers or sump pits.

(d) You must construct and install direct gas-fired tank heaters, as follows:

(i) You must only install direct gas-fired tank heaters, and tanks to which they are applied, above ground.

(ii) You must permanently mark tank heaters with the name of the manufacturer, the rated B.T.U. input to the burner, and the maximum vaporizing capacity in gallons per hour.

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

(iii) You must provide tank heaters with a means for manually turning off the gas to the main burner and pilot.

(iv) You must equip tank heaters with an automatic safety device to shut off the flow of gas to main burners, if the pilot light should fail. When flow through pilot exceeds 2,000 B.T.U. per hour, you must also equip the pilot with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(v) You must separate pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired tank heater from the open flame by a substantially airtight noncombustible partition.

(vi) You must maintain the following minimum distances between a storage tank heated by a direct fired tank heater and the nearest important building or group of buildings or line of adjoining property which may be built upon:

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

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

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

(vii) No direct fired tank heater must raise the product pressure within the storage container over 75% of the pressure set out in the second column of Table H-31. (See WAC 296-24-47509.)

(e) You must locate the vaporizer section of vaporizer-burners used for dehydrators or dryers outside of buildings; they must be constructed and installed as follows:

(i) Vaporizer-burners must have a minimum design pressure of 250 p.s.i.g. with a factor of safety of 5.

(ii) Manually operated positive shutoff valves must be located at the containers to shut off all flow to the vaporizer-burners.

(iii) Minimum distances between storage containers and vaporizer-burners must be as follows:

Water capacity per container (gallons)	Minimum distances (feet)
Less than 501	10
501 to 2,000	25
Over 2,000	50

(iv) You must protect the vaporizer section of vaporizer-burners by a hydrostatic relief valve. The relief valve must be located so as not to be subjected to temperatures in excess of 140°F. The start-to-discharge pressure setting must be such as to protect the components involved, but not less than 250 p.s.i.g. You must direct the discharge upward and away from component parts of the equipment and away from operating personnel.

(v) You must provide vaporizer-burners with means for manually turning off the gas to the main burner and pilot.

(vi) You must equip vaporizer-burners with automatic safety devices to shut off the flow of gas to the main burner and pilot in the event the pilot is extinguished.

(vii) You must locate or protect pressure regulating and control equipment so that the temperatures surrounding this equipment do not exceed 140°F except that equipment components may be used at higher temperatures if designed to withstand such temperatures.

(viii) Pressure regulating and control equipment when located downstream of the vaporizer must be designed to withstand the maximum discharge temperature of the vapor.

(ix) You must not provide the vaporizer section of vaporizer-burners with fusible plugs.

(x) Vaporizer coils or jackets must be made of ferrous metal or high temperature alloys.

(xi) You must equip equipment utilizing vaporizer-burners with automatic shutoff devices upstream and downstream of the vaporizer section connected so as to operate in the event of excessive temperature, flame failure, and, if applicable, insufficient airflow.

(12) **Filling densities.**

(a) The "filling density" is defined as the percent ratio of the weight of the gas in a container to the weight of water the container will hold at 60°F. You must fill all containers according to the filling densities shown in Table H-27.

TABLE H-27
MAXIMUM PERMITTED FILLING DENSITY

Specific gravity at 60°F (15.6°C)	Above ground containers		Under-ground containers, all capacities
	0 to 1,200 U.S. gals. (1,000 imp. gal. 4,550 liters) total water cap.	Over 1,200 U.S. gals. (1,000 imp. gals. 4,550 liters) total water cap.	
	%	%	
0.496-0.503	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

(b) Except as provided in (c) of this subsection, you must charge any container including mobile cargo tanks and portable tank containers regardless of size or construction, shipped under DOT jurisdiction or constructed in accordance with 49 C.F.R. Chapter I specifications according to 49 C.F.R. Chapter I requirements.

(c) Portable containers not subject to DOT jurisdiction (such as, but not limited to, motor fuel containers on industrial and lift trucks, and farm tractors covered in subsection (5) of this section, or containers recharged at the installation) may be filled either by weight, or by volume using a fixed length dip tube gaging device.

(13) **LP-gas in buildings.**

(a) You must pipe vapor into buildings at pressures in excess of 20 p.s.i.g. only if the buildings or separate areas thereof,

(i) Are constructed in accordance with this section;

(ii) Are used exclusively to house equipment for vaporization, pressure reduction, gas mixing, gas manufacturing, or distribution, or to house internal combustion engines, industrial processes, research and experimental laboratories, or equipment and processes using such gas and having similar hazard;

(iii) Buildings, structures, or equipment under construction or undergoing major renovation.

(b) Liquid may be permitted in buildings as follows:

(i) Buildings, or separate areas of buildings, used exclusively to house equipment for vaporization, pressure reduction, gas mixing, gas manufacturing, or distribution, or to house internal combustion engines, industrial processes, research and experimental laboratories, or equipment and processes using such gas and having similar hazard; and when such buildings, or separate areas thereof are constructed in accordance with this section.

(ii) Buildings, structures, or equipment under construction or undergoing major renovation provided the temporary piping meets the following conditions:

(A) Liquid piping inside the building must conform to the requirements of subsection (8) of this section, and must not exceed 3/4 iron pipe size. Copper tubing with an outside diameter of 3/4 inch or less may be used provided it conforms to Type K of Specifications for Seamless Water Tube, ANSI H23.1-1970 (ASTM B88-1969) (see WAC 296-24-47505 Table H-24). You must protect all such piping against construction hazards. You must keep liquid piping inside buildings to a minimum. You must securely fasten such piping to walls or other surfaces so as to provide adequate protection from breakage and so located as to subject the liquid line to lowest ambient temperatures.

(B) You must install a shutoff valve in each intermediate branch line where it takes off the main line and it must be readily accessible. You must also place a shutoff valve at the appliance end of the intermediate branch line. Such shutoff valve must be upstream of any flexible connector used with the appliance.

(C) You must install suitable excess flow valves in the container outlet line supplying liquid LP-gas to the building. You must install a suitable excess flow valve immediately downstream of each shutoff valve. You must install suitable excess flow valves where piping size is reduced and it must be sized for the reduced size piping.

(D) You must install hydrostatic relief valves in accordance with subsection (10)(m) of this section.

(E) You must prohibit the use of hose to carry liquid between the container and the building or at any point in the liquid line, except at the appliance connector.

(F) Where flexible connectors are necessary for appliance installation, such connectors must be as short as practicable and must comply with subsection (8)(b) or (9) of this section.

(G) You must minimize release of fuel when any section of piping or appliances is disconnected by either of the following methods:

(I) Using an approved automatic quick-closing coupling (a type closing in both directions when coupled in the fuel line), or

(II) Closing the valve nearest to the appliance and allowing the appliance to operate until the fuel in the line is consumed.

(III) You must not take portable containers into buildings except as provided in subsection (6)(a) of this section.

(14) **Transfer of liquids.** You must ensure that:

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

(b) You must fill or use containers only upon authorization of the owner.

(c) You must not refill or reuse containers manufactured in accordance with specifications of 49 C.F.R. Part 178 and authorized by 49 C.F.R. Chapter 1 as a "single trip" or "nonrefillable container" in LP-gas service.

(d) Gas or liquid must not be vented to the atmosphere to assist in transferring contents of one container to another, except as provided in WAC 296-24-47511 (5)(d) and except that this must not preclude the use of listed pump utilizing LP-gas in the vapor phase as a source of energy and venting such gas to the atmosphere at a rate not to exceed that from a No. 31 drill size opening and provided that such venting and liquid transfer must be located not less than 50 feet from the nearest important building.

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

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

(g) The filling connection and the vent from the liquid level gauges in containers, filled at point of installation, must not be less than 10 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(h) You must gauge and charge fuel supply containers only in the open air or in buildings especially provided for that purpose.

(i) The maximum vapor pressure of the product at 100°F which may be transferred into a container must be in accordance with WAC 296-24-47509(2) and 296-24-47511(3). (For DOT containers use DOT requirements.)

(j) Marketers and users must exercise precaution to assure that only those gases for which the system is designed, examined, and listed, are employed in its operation, particularly with regard to pressures.

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

(l) Pumping systems, when equipped with a positive displacement pump, must include a recirculating device which must limit the differential pressure on the pump under normal operating conditions to the maximum differential pressure rating of the pump. You must protect the discharge of the pumping system so that pressure does not exceed 350 p.s.i.g. If a recirculation system discharges into the supply tank and contains a manual shutoff valve, you must incorporate an adequate secondary safety recirculation system which has no means of rendering it inoperative. You must keep manual shutoff valves in recirculation systems open except during an emergency or when repairs are being made to the system.

(m) When necessary, you must provide unloading piping or hoses with suitable bleeder valves for relieving pressure before disconnection.

(n) You must shut down agricultural air moving equipment, including crop dryers, when supply containers are being filled unless the air intakes and sources of ignition on the equipment are located fifty feet or more from the container.

(o) You must shut down agricultural equipment employing open flames or equipment with integral containers, such as flame cultivators, weed burners, and, in addition, tractors, during refueling.

(15) Tank car or transport truck loading or unloading points and operations.

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

(b) You must install a "tank car connected" sign, as covered by DOT rules, at the active end or ends of the siding while the tank car is connected.

(c) While cars are on side track for loading or unloading, you must block the wheels at both ends on the rails.

(d) You must ensure that an employee is in attendance at all times while the tank car, cars, or trucks are being loaded or unloaded.

(e) You must install a backflow check valve, excess-flow valve, or a shutoff valve with means of remote closing, to protect against uncontrolled discharge of LP-gas from storage tank piping close to the point where the liquid piping and hose or swing joint pipe is connected.

(f) Where practical, the distance of the unloading or loading point must conform to the distances in subsection (6)(b) of this section.

(16) Instructions. You must properly train personnel performing installation, removal, operation, and maintenance work in such function.

(17) Electrical equipment and other sources of ignition.

(a) Electrical equipment and wiring must be of a type specified by and you must install it according to chapter 296-24 WAC Part L, for ordinary locations except that fixed electrical equipment in classified areas must comply with subsection (18) of this section.

(b) You must not permit open flames or other sources of ignition in vaporizer rooms (except those housing direct-fired vaporizers), pumphouses, container charging rooms or other similar locations. Direct-fired vaporizers shall not be permitted in pumphouses or container charging rooms.

Note: Liquefied petroleum gas storage containers do not require lightning protection. Since liquefied petroleum gas is contained in a closed system of piping and equipment, the system need not be electrically conductive or electrically bonded for protection against static electricity (see NFPA No. 77-1972-1973, Recommended Practice for Static Electricity).

(c) You must not open flames (except as provided for in (b) of this subsection), cutting or welding, portable electric tools, and extension lights capable of igniting LP-gas, within classified areas specified in Table H-28 of this section unless the LP-gas facilities have been freed of all liquid and vapor, or special precautions observed under carefully controlled conditions.

(18) Fixed electrical equipment in classified areas. Fixed electrical equipment and wiring installed within classified areas must comply with Table H-28 of this section and must be installed according to chapter 296-24 WAC Part L. This provision does not apply to fixed electrical equipment at residential or commercial installations of LP-gas systems or to systems covered by WAC 296-24-47511.

(19) Liquid-level gaging device.

(a) You must equip each container manufactured after December 31, 1965, and filled on a volumetric basis with a fixed liquid-level gage to indicate the maximum permitted filling level as provided in (e) of this subsection. Each container manufactured after December 31, 1969, must have permanently attached to the container adjacent to the fixed level gage a marking showing the percentage full that will be shown by that gage. When a variable liquid-level gage is also provided, the fixed liquid-level gage will also serve as a means for checking the

variable gage. You must use these gages in charging containers as required in subsection (12) of this section.

(b) You must arrange all variable gauging devices so that the maximum liquid level for butane, for a 50/50 mixture of butane and propane, and for propane, to which the container may be charged is readily determinable. The markings indicating the various liquid levels from empty to full must be on the system nameplate or gauging device or part may be on the system nameplate and part on the gauging device. Dials of magnetic or rotary gauges must show whether they are for cylindrical or spherical containers and whether for aboveground or underground service. You must mark the dials of gauges intended for use only on aboveground containers of over 1,200 gallons water capacity.

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

(d) Gauging devices must have a design working pressure of at least 250 p.s.i.g.

(e) Length of tube or position of fixed liquid-level gauge must be designed to indicate the maximum level to which the container may be filled for the product contained. You must base this level on the volume of the product at 40°F at its maximum permitted filling density for aboveground containers and at 50°F for underground containers. You must calculate the filling point for which the fixed liquid level gage is designed according to the method in this subsection.

TABLE H-28

Part	Location	Extent of classified area ¹	Equipment must be suitable for Class 1, Group D ²
A	Storage containers other than DOT cylinders.	Within 15 feet in all directions from connections, except connections otherwise covered in Table H-28.	Division 2.
B	Tank vehicle and tank car loading and unloading. ³	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade. (See Figure H-1.)	Division 2.
C	Gage vent openings other than those on DOT cylinders.	Within 5 feet in all directions from point of discharge.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from point of discharge.	Division 2.

Part	Location	Extent of classified area ¹	Equipment must be suitable for Class I, Group D ²
D	Relief valve discharge other than those on DOT cylinders.	Within direct path of discharge.	Division 1. NOTE—Fixed electrical equipment should preferably not be installed.
		Within 5 feet in all directions from point of discharge.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from point of discharge except within the direct path of discharge.	Division 2.
E	Pumps, compressors, gas-air mixers and vaporizers other than direct fired.	Indoors without ventilation	Division 1.
			Division 2.
		Indoors with adequate ventilation. ⁴	Division 2.
		Outdoors in open air at or abovegrade.	Division 2.
			Division 2.
F	Service station dispensing units.	Entire space within dispenser enclosure, and 18 inches horizontally from enclosure exterior up to an elevation 4 ft. above dispenser base. Entire pit or open space beneath dispenser.	Division 1.
		Up to 18 inches abovegrade within 20 ft. horizontally from any edge of enclosure.	Division 2.
		NOTE: For pits within this area, see Part F of this table.	
G	Pits or trenches containing or located beneath LP-gas valves, pumps, compressors, regulators, and similar equipment.		

Part	Location	Extent of classified area ¹	Equipment must be suitable for Class I, Group D ²
	Without mechanical ventilation.	Entire pit or trench	Division 1.
		Entire room and any adjacent room not separated by a gastight partition.	Division 2.
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2.
	With adequate mechanical ventilation.	Entire pit or trench	Division 2
		Entire room and any adjacent room not separated by a gastight partition.	Division 2.
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2.
H	Special buildings or rooms for storage of portable containers.	Entire room	Division 2.
I	Pipelines and connections containing operational bleeds, drips, vents or drains.	Within 5 ft. in all directions from point of discharge.	Division 1.
		Beyond 5 ft. from point of discharge, same as Part E of this table.	
J	Container filling: Indoors without ventilation.	Entire room	Division 1.
	Indoors with adequate ventilation. ⁴	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet and entire room	Division 2.
	Outdoors in open air	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade (See Fig. H-1.)	Division 2.

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

² See chapter 296-46 WAC, and chapter 296-24 WAC Part L.

- 3 When classifying extent of hazardous area, you must give consideration to possible variations in the spotting of tank cars and tank vehicles at the unloading points and the effect these variations of actual spotting point may have on the point of connection.
- 4 Ventilation, either natural or mechanical, is considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25% of the lower flammable limit under normal operating conditions.

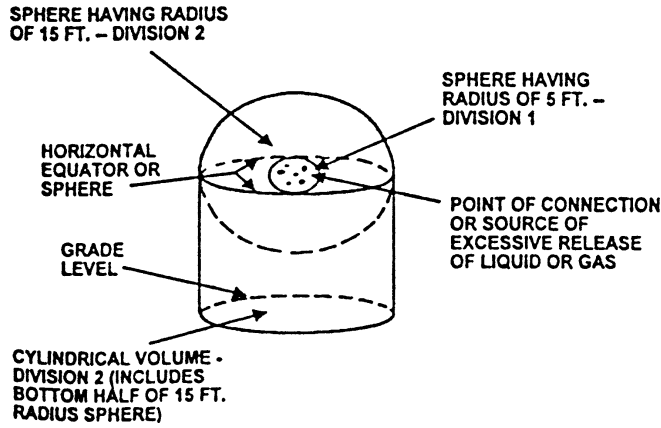


Figure H-1

Note: It is impossible to set out in a table the length of a fixed dip tube for various capacity tanks because of the varying tank diameters and lengths and because the tank may be installed either in a vertical or horizontal position. Knowing the maximum permitted filling volume in gallons, however, the length of the fixed tube can be determined by the use of a strapping table obtained from the container manufacturer. The length of the fixed tube should be such that when its lower end touches the surface of the liquid in the container, the contents of the container will be the maximum permitted volume as determined by the following formula:

$$\frac{\text{Water capacity (gals.) of container* x filling density**}}{\text{Specific gravity of LP-gas* x volume correction factor*** x 100}} = \text{Maximum volume of LP-gas}$$

* Measure at 60°F.

** From subsection (12)(a) of this section "filling densities."

*** For aboveground containers the liquid temperature is assumed to be 40°F and for underground containers the liquid temperature is assumed to be 50°F. To correct the liquid volumes at these temperatures to 60°F you must use the following factors.

(i) Formula for determining maximum volume of liquefied petroleum gas for which a fixed length of dip tube must be set:

TABLE H-29
VOLUME CORRECTION FACTORS

Specific gravity	Aboveground	Underground
0.500	1.033	1.017
.510	1.031	1.016
.520	1.029	1.015
.530	1.028	1.014
.540	1.026	1.013
.550	1.025	1.013
.560	1.024	1.012
.570	1.023	1.011
.580	1.021	1.011
.590	1.020	1.010

(ii) The maximum volume of LP-gas which can be placed in a container when determining the length of the dip tube expressed as a per-

centage of total water content of the container is calculated by the following formula.

(iii) The maximum weight of LP-gas which may be placed in a container for determining the length of a fixed dip tube is determined by multiplying the maximum volume of liquefied petroleum gas obtained by the formula in (e)(i) of this subsection by the pounds of liquefied petroleum gas in a gallon at 40°F for aboveground and at 50°F for underground containers. For example, typical pounds per gallon are specified below:

Example: Assume a one hundred-gallon total water capacity tank for aboveground storage of propane having a specific gravity of 0.510 of 60°F.

$$\frac{100 \text{ (gals.)} \times 42 \text{ (filling density from (12)(a) of this subsection)}}{0.510 \times 1.031 \text{ (correction factor from Table H-29)} \times 100} = \frac{4200}{52.6}$$

$$\frac{4200}{52.6} = 79.8 \text{ gallons propane, the maximum amount permitted to be placed in a 100-gallon total water capacity aboveground container equipped with a fixed dip tube.}$$

$$\frac{\text{Maximum volume of LP-gas (from formula in (e)(i) of this subsection)} \times 100}{\text{Total water content of container in gallons.}} = \text{Maximum \% of LP-gas}$$

	Aboveground, pounds per gallon	Underground, pounds per gallon
Propane.	4.37	4.31
N Butane.	4.97	4.92

(f) You must stamp fixed liquid-level gages used on containers other than DOT containers on the exterior of the gage with the letters "DT" followed by the vertical distance (expressed in inches and carried out to one decimal place) from the top of container to the end of the dip tube or to the centerline of the gage when it is located at the maximum permitted filling level. For portable containers that may be filled in the horizontal and/or vertical position the letters "DT" must be followed by "V" with the vertical distance from the top of the container to the end of the dip tube for vertical filling and with "H" followed by the proper distance for horizontal filling. For DOT containers you must place the stamping both on the exterior of the gage and on the container. On aboveground or cargo containers where the gages are positioned at specific levels, the marking may be specified in percent of total tank contents and you must stamp the marking on the container.

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

(h) 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.

(20) Requirements for appliances.

(a) Except as provided in (b) of this subsection, new commercial and industrial gas consuming appliances must be approved.

(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.

(c) You must equip unattended heaters used inside buildings for the purpose of animal or poultry production or care with an approved automatic device designed to shut off the flow of gas to the main burners, and pilot if used, in the event of flame extinguishment.

(d) You must install all commercial, industrial, and agricultural appliances or equipment in accordance with the requirements of these standards and in accordance with the following:

(i) Domestic and commercial appliances—NFPA 54-1969, Standard for the Installation of Gas Appliances and Gas Piping.

(ii) Industrial appliances—NFPA 54A-1969, Standard for the Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises.

(iii) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines—NFPA 37-1970.

(iv) Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment, NFPA 96-1970.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, and 49.17.060. WSR 17-02-066, § 296-24-47505, filed 1/3/17, effective 2/3/17; WSR 15-24-100, § 296-24-47505, filed 12/1/15, effective 1/5/16. Statutory Authority: RCW 49.17.010, [49.17].040 and [49.17].050. WSR 99-17-094, § 296-24-47505, filed 8/17/99, effective 12/1/99. Statutory Authority: Chapter 49.17 RCW. WSR 91-24-017 (Order 91-07), § 296-24-47505, filed 11/22/91, effective 12/24/91; WSR 88-23-054 (Order 88-25), § 296-24-47505, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 85-10-004 (Order 85-09), § 296-24-47505, filed 4/19/85; Order 76-6, § 296-24-47505, filed 3/1/76; Order 73-5, § 296-24-47505, filed 5/9/73 and Order 73-4, § 296-24-47505, filed 5/7/73.]